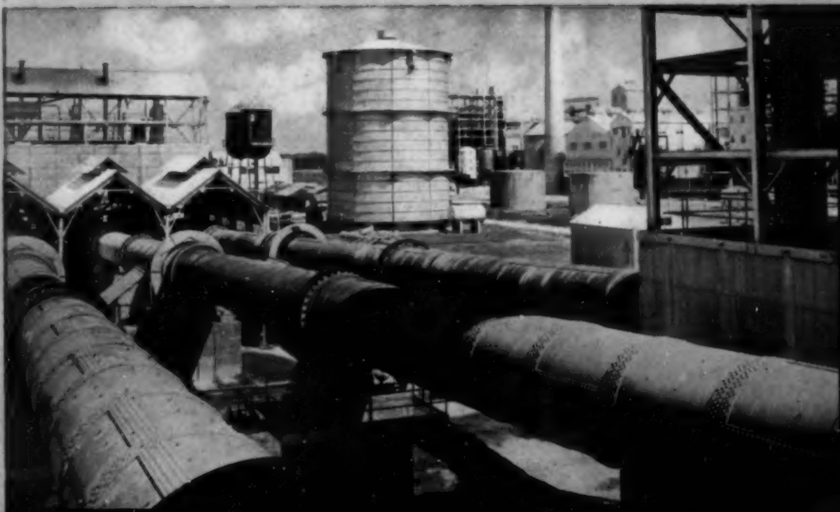
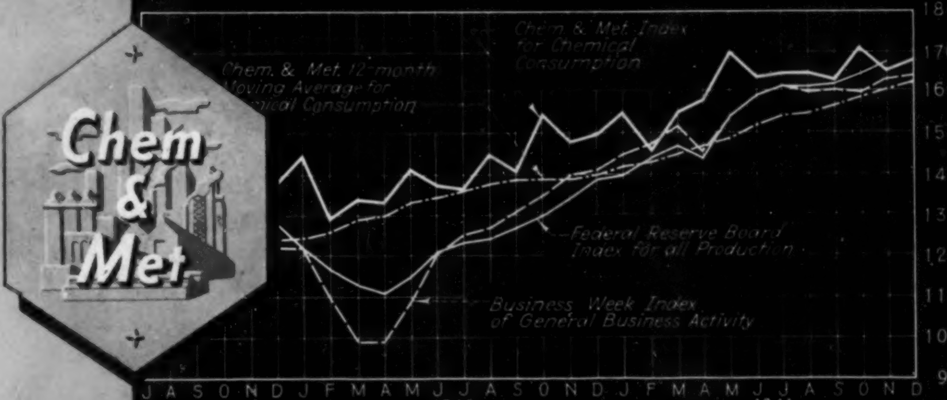
CHEMICAL
& METALLURGICAL
ENGINEERING



FEBRUARY, 1942

BARROMETER OF BUSINESS, BACKBONE OF INDUSTRY

Alkalis need no alibis in America! How that great industry is meeting war demands is told on pp. 84-5 and the operations of one of its most modern ammonia-soda plants are shown in pictures and flowsheet on pp. 143-7



UP GO ALL THE CURVES OF CHEMICALS FOR VICTORY!

Chem. & Met's nineteenth annual review and statistical section — fourth of its famous "Facts and Figures" issues — brings forth basic information on raw materials to help in converting American chemical industry from peace to war basis. See pp. 73-112

SYNTHETIC RUBBER—1942's GREATEST CHALLENGE

Jesse Jones' dramatic announcement of plans for explosive expansion of synthetic rubber calls for tremendous mobilization of the resources of chemical, rubber and petroleum industries. See pp. 89 and 113-15 for first of series of economic and technical studies

WASHINGTON NEWS pp. 142-3

NEXT MONTH

To prepare the *Chem. & Met.* Report for March, the Editors have enlisted the aid of an outstanding authority in the field of industrial use of electronic devices. The report will be the first of two on the utilization of such devices for the control of chemical engineering processes. Together, the two reports will go thoroughly into the principles and into well known, as well as less familiar, applications of these light sensitive and electrically controlled detectors and relay devices.

McGRAW-HILL

PUBLISHING COMPANY, INC.

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CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902

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CHEMICAL
& METALLURGICAL
ENGINEERING

ESTABLISHED 1902

S. D. KIRKPATRICK, Editor

FEBRUARY, 1942

Chemicals for Victory

One of the toughest jobs facing the War Production Board's new Requirements Committee is to gage Old Man Mars' chemical appetite. Of course, his needs for ammonia and toluol, sulphuric and nitric acids may be readily calculated once the explosives program is established. Likewise, there are probably 20 or 30 other chemical raw materials directly used in making munitions and for which the necessary requirements are fairly well known. But the hitch comes in connection with basic commodities that serve essential civilian needs and through them contribute both directly and indirectly to the war program.

Chlorine is a good example. Ask the large airplane manufacturer how much he uses in building a big bomber and he will look at you in amazement. He probably knows his needs for aluminum and magnesium, stainless steel and rubber, down to the fraction of a pound. Yet he's never given any thought to chlorine or is sure that it is relatively unimportant to him. He'd likely be quite surprised when you point out that at least a dozen of the ingredients of his plane could not be made without substantial quantities of this "poison gas." The thousand pounds of magnesium in a big bomber was probably made from 4,000 lb. of magnesium chloride containing more than a ton of chlorine. The quantities of trichlorethylene or other chlorinated solvents used in vapor degreasing of metal parts are now surprisingly large. The ethylene glycol in the liquid-cooled engines and the tetraethyl lead in the 100-octane aviation fuels are among the largest indirect users of chlorine. Synthetic rubber of the neoprene type, plastics and resins like polyvinyl chloride, titanium tetrachloride and other smoke-making materials, acetylene tetrachloride and chlorinated waxes used as impregnants in tarpaulins, sulphur chloride and other additives in lubricating oils and, we mustn't forget the carbon tetrachloride in the fire extinguishers—all these and probably many more uses for chlorine are absolutely essential to the aircraft industry. And how can their requirements be calculated by W.P.B. except to say "Give us all you've got and all you can make—and then some!"

Still another angle of this problem vitally concerns our industries. Too little understanding of the essential importance of chemicals is often combined with too much mystery and ignorance about their origin and manufacture. This has already resulted in unfair criticism and lack of patience in working out some production schedules. It takes but eight or nine months to build a huge smokeless powder or TNT plant, but as chemical engineers we know we are exceedingly lucky in these times if we can complete a synthetic ammonia

works in even twice that period. The airplane manufacturer who finds that he needs a handful of "magooslum" (apologies to Donald Keyes!) to complete his electrical insulation or to connect up his bullet-proof gasoline tanks, just can't understand why there should be so much difficulty and delay in getting it to him. "Don't you people advertise that it's made out of 'coal, air and water' and since when did they go on the priority lists?"

It doesn't help very much to tell him that "magooslum" cannot be cooked up in ordinary kitchen kettles, but must be synthesized under high temperatures and pressures by complicated processes in costly plants that are already operating 168 hours a week! A somewhat similar story is going to have to be told soon to a lot of automobile drivers who are expecting to ride on synthetic rubber tires before this year is out. So it begins to look as though chemical industry has a new public relations job to do—or an old one to undo—in order that there may be a more sympathetic understanding of the methods of origin as well as the vital part that chemicals play in the national economy.

Let's paste up on our own bulletin boards and repeat on every possible occasion in our dealings with the public: "Without chemicals a plane remains unbuilt, a tank lies unused, an army cannot advance! That's why we're pushing the production of Chemicals for Victory."

WASHINGTON HIGHLIGHTS

ENGINEERS occupy top positions in W.P.B. Nelson graduated in chemical engineering at Missouri, Batt in mechanical engineering at Purdue and Knowlson in electrical engineering at Cornell. Some see here the foreshadow of somebody's plan for a post-war "engineering economy."

POOLING is a word that's going to be heard oftener from now on. Whether it applies to patents, processes and technical skills, as in synthetic rubber, or to tools, plant facilities and even unfilled orders, as in some mechanical industries, the objective is the same, viz., get out the goods, regardless of legal impediments.

COMPLACENCY is dangerous. Pearl Harbor proved this for the military forces. Washington emphasizes that it is equally dangerous for industry. Tremendous speed-up is demanded. More important, quick changes in manufacturing programs will be needed. Chemical engineers are urged to avoid thinking that any program is fixed except the objective that "we want more."

TARIFF REPEAL is practically promised to Latin America in certain agreements reached at the Rio conference. This is only part of the emergency program to secure complete unity of action in this hemisphere. But when the farm bloc and certain mining state representatives find out about this, there will be bitter controversy on Capitol Hill.

SCRAP should be classified. Chemical industries produce some wastes worthy of salvage. Under present conditions every plant is urged to make it the business of certain competent individuals to see that this scrap is saved. To make recovered material more valuable it should be carefully classified. Some commodities must be turned back to original sources. Others can be sold to the junk man. Important thing is "save and salvage."

BONUS PRICES will be paid by RFC for increased production of lead, zinc, and copper. A similar plan could probably be applied for certain chemical products. Any high-cost producer of scarce or critical commodities should present his case promptly to the appropriate commodity division of W.P.B. There he can find out whether they want his output bad enough to ask Loan Administrator Jesse Jones to buy it at prices above the official ceilings.

COLLEGE SPEED-UP is intended to produce fully trained chemical engineers in 33 to 36 months instead of the customary 45. No curtailment of technical content of courses is planned. Speed will be obtained principally by eliminating vacations and shortening the inter-term periods. This program supplements, but does not supersede the special defense courses directed by the Office of Education which are providing about 200,000 registrants specially trained for particular needs.

MANPOWER problems complicate the production picture. General Hershey's statement (see page 119) that there is an adequate supply of replacement personnel for all men now subject to call scarcely applied to chemical engineers. Employers report that relatively few good men over 45 are still available and as for lady engineers, there aren't any. The universities are, therefore, the only place to get trained chemical manpower and there is increasing military competion there, especially with the Navy.

MAINTENANCE of chemical operations at full capacity was recognized January 26 in preference rating P-89 as of vital concern to military and essential civilian needs. Hence highest possible priorities, beginning with A-1-a, are now provided to cover repair of actual breakdowns and to avert immediately threatened stoppages in war industries.

CONVERSION is also becoming more important in Washington's vocabulary. It has a religious connotation, too, that must not be overlooked as W.P.B. begins to turn the heat on the boys in the back row. Nelson has said "Plants and industries not slated for conversion will have more and more difficulty in obtaining materials as increased emphasis is placed on war production and the most essential products for the health and welfare of the civilian population."

DOLLAR-A-YEAR men in the defence agencies need no defense before carping Congressmen. Their employment in times of national emergency was specifically authorized by Congress itself. The recent Truman committee did not report a single case of impropriety. The only alternative is to let men who never earned more than $8,000 to $10,000 a year handle vital projects and make million dollar decisions without possession on their part of more than a casual acquaintance with the underlying facts and the background of industrial experience.

CHEM & MET REPORT ON

FACTS AND FIGURES

of American Chemical Industry

NINETEENTH ANNUAL REVIEW
AND STATISTICAL SECTION

For almost 20 years, these annual review issues have helped chemical engineers and executives to chart their course in the peace-time progress of the process industries. Now our objectives have changed. We are faced with the task of converting our industries into an efficient war machine, to out-produce our most powerful enemies. We must push many lines of manufacture far beyond their normal capacities. We must anticipate almost unbelievable demands for chemical raw materials — and provide them without dislocations that might curtail war production in entirely unpredicted directions. All the more essential, therefore, are the basic facts and figures that will permit us to play our part most effectively in the nation's program. So, within the limits of careful censorship to make certain that we do not reveal information of value to our enemies, the editors of *Chem. & Met.* set up in this report those economic and technical guide posts that will help American chemical industry as it advances further to meet the challenges of total war.

CHEMICALS GO TO WAR!

American Chemical Industry plays its part by multiplying its production of essential raw materials, by devising new products and processes, by ministering to national health, safety and security—all on a scale that can mean naught but victory

ANNUAL REPORT by the Editors of Chem. & Met. to Stockholders, Customers and Employees

LOOKING BACK

MUCH of what we now know as the American Chemical Industry had its birth and early struggles during the first World War. Coming from such an origin, the layman would naturally suppose that transition from peace to war basis would be comparatively easy for the chemical manufacturer. But that is far from the case, as the trials and troubles of the past year clearly proved. Much of the direct military load had to be superimposed on the foundations of normal industry. A billion dollars, largely from governmental sources, had to be spent for entirely new plants to produce powder, explosives and chemical munitions. As these plants were readied for production during the summer and early fall, it became evident that their needs for raw materials and personnel were greater than could be supplied without curtailing many less essential lines of manufacture. "Business as usual" in chemical industry was out, long before Pearl Harbor! Yet there has been surprisingly little confusion or hesitation as the pattern for still greater war production unfolded.

Practically all chemical plants operated at full capacity during 1941—some of them in excess of their rated capacities. Yet no surplus stocks are held by either producers or consumers. Industrial consumption of chemicals, as measured by the *Chem. & Met.* index, increased more than 20 percent while production which had to take care of direct military needs as well as greatly enlarged exports, has shown even greater gain, according to the Federal Reserve Board. Chemical shipments abroad were averaging more than $25,000,000 a month by September which is the last month for which detailed figures are to be published. Chemical prices, that clung tenaciously to the 1937 level for the first six months of 1941, rose to 104 percent of 1937 in August and to 109 at the turn of the year,—the highest average level since 1930.

Substantial increases in wages and taxes were reflected in higher operating costs and lower net earnings by many companies, even though reporting a greatly increased volume of business. There was little or no direct curtailment of research, although some departments were robbed of key personnel for war work. In a number of companies, men engaged in market research were diverted to post-war studies looking toward the inevitable day when our greatly expanded industries will be demobilized for peaceful pursuits. This forward thinking and planning is encouraging evidence that the American Chemical Industry is already preparing to open up new markets and new fields for service, once the present unpleasant job is done. In the meantime, however, all of our men, money and materials are concentrated on a production program so tremendous that it can mean but one thing—Victory!

LOOKING AHEAD

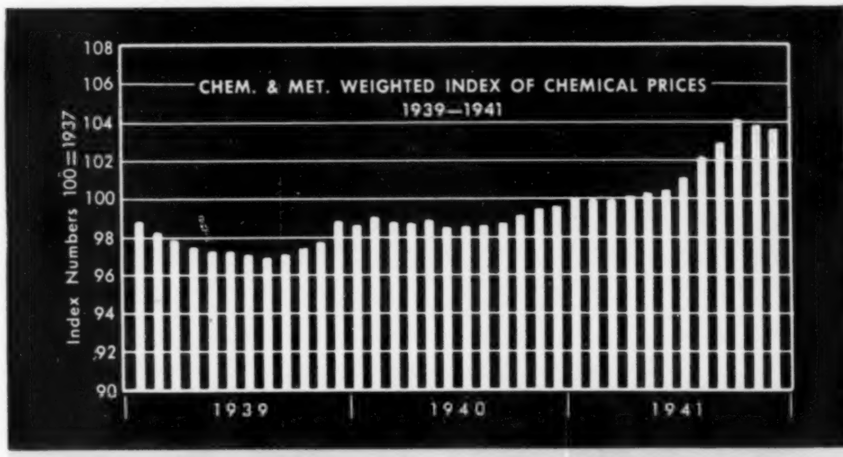
PRESIDENT ROOSEVELT has said: " . . . We shall need and demand—money, materials, doubled and quadrupled production . . . ever increasing. . . . Your government has decided on two broad policies: the first is to speed up existing production by working on a seven-day week basis in every war industry, including the production of essential raw materials. The second policy, now being put into form, is to rush additions to the capacity of production by building more new plants, by adding to old plants and by using the many smaller plants for war needs."

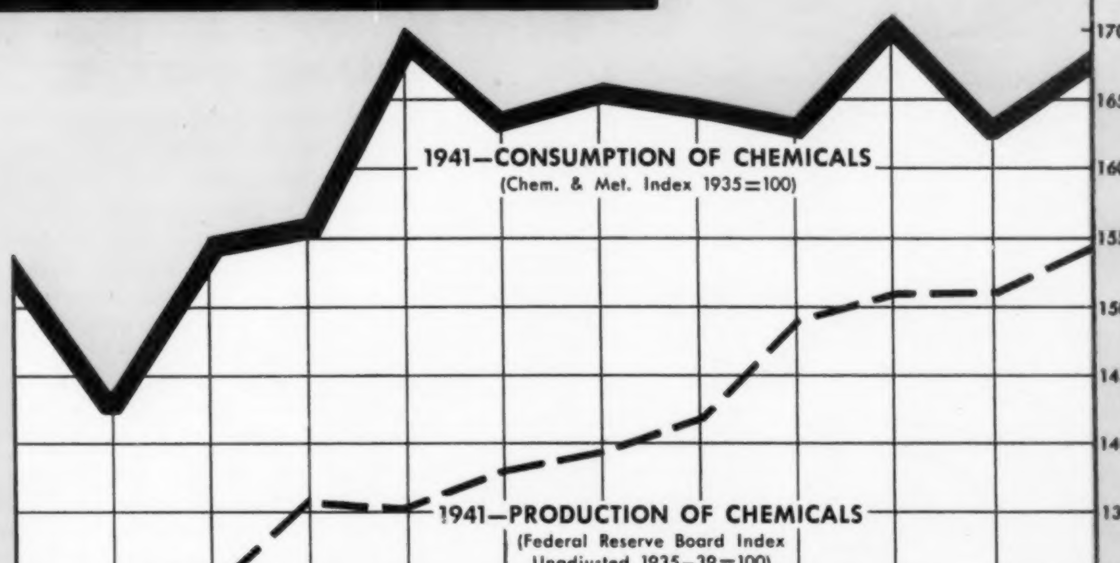
Donald M. Nelson has said: "Plants and industries not slated for conversion will have more and more difficulty in obtaining materials as increased emphasis is placed on war production and the most essential products for the health and welfare of the civilian population."

Clearly then, the job for American Chemical Industry in 1942 is complete conversion to an efficient machine for producing war materials and essential civilian goods. We can and must look forward to further expansion. Doubling and redoubling is to be expected for some products of direct military uses. One of the most far-reaching challenges, to be shared with the petroleum and rubber industries, is the urgent need for manufacturing synthetic rubber on ten times the scale of that of any other nation in the world. Pooling of patents, processes and facilities will help to speed the program that must be completed before the end of 1943. Otherwise we face the dire consequences of a transportation crisis and a breakdown of many essential services and supplies.

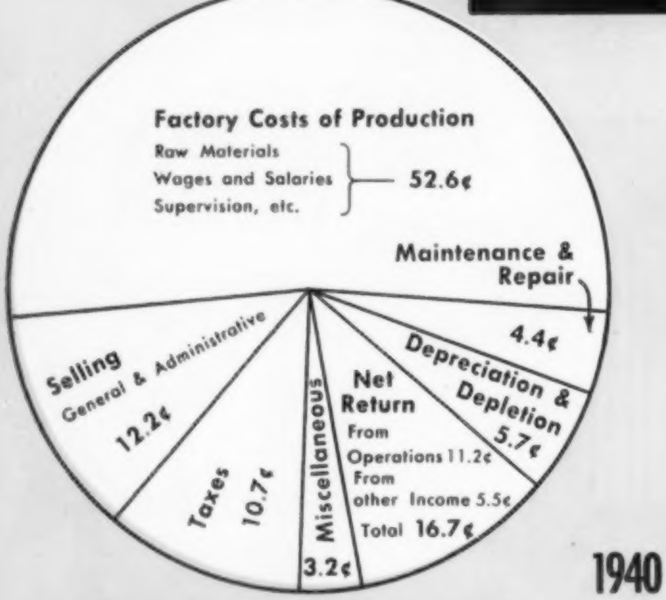
As one after another of the chemicals are commandeered for war uses, the industry faces the necessity for developing acceptable substitutes and alternative processes, using available raw materials and equipment. The job is not an easy one, but certainly comes within the resources and abilities inherent in the American Chemical Industry.

In speeding up and pushing forward the program



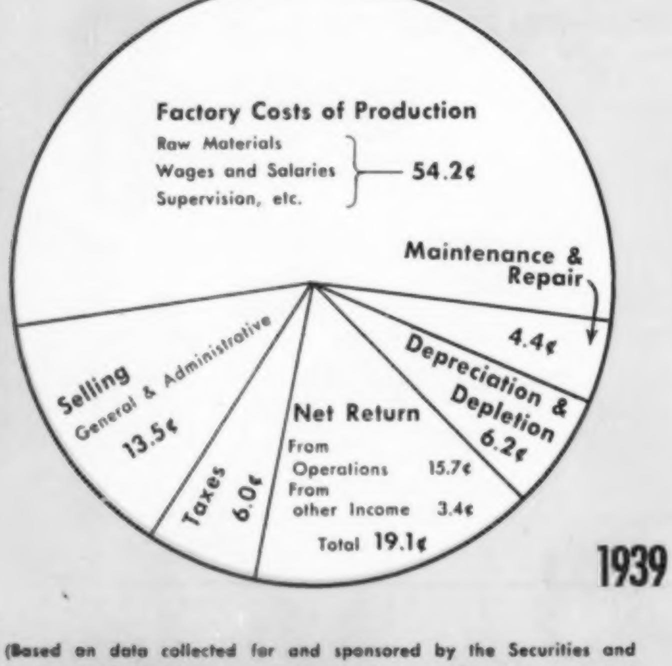


COMBINED TOTALS for 38 Chemical Corporations (Dollar Figures in Millions)	1940	1939
Net Sales	$1,253	$1,047
Net Profit from Operations	275	189
Net Profit after All Charges	210	200
Total Dividends	165	160
Total Assets	2,102	1,946
Capital Stock	900	919
Surplus	733	678
Net Profit from Operations in Percent of Sales	21.9%	18.0%
Net Profit after All Charges in Percent of Sales	16.7%	19.1%
Ratio of Current Assets to Current Liabilities	3.35	5.49



1940

WHAT BECOMES OF THE CHEMICAL SALES DOLLAR?



1939

(Based on data collected for and sponsored by the Securities and Exchange Commission covering operations of 38 listed chemical corporations)

of war production, a heavy responsibility rests on all of us. Safety must still be our primary consideration. Plants must be protected against sabotage and incendiarism. Every precaution must be taken to avoid work stoppages that will delay the job of getting and keeping American Chemical Industry at peak performance.

Again quoting Mr. Nelson: "Only results count! We don't want any alibis or excuses. I don't want them; the President doesn't want them; the people of the United States certainly are not interested in them. Those goals for 1942 can be met. They *will* be met."

BALANCE SHEET

LACKING a complete and comprehensive compilation of the assets and liabilities of the several hundred companies that comprise the American Chemical Industry, perhaps the best substitute is the annual report issued November, 1941, under the sponsorship of the Securities and Exchange Commission as part of its series of "Surveys of American Listed Corporations." This report (No. 6) on "Chemicals and Fertilizers" gives for the first time a segregation of these companies between the two major divisions. Under "Chemicals" we find financial data for 38 listed corporations. To be sure, most of these are the larger corporations having assets of at least $10,000,000, but a few smaller companies are included and in the main, the overall characteristics are typical of chemical industry as a whole.

The accompanying table presents a combined profit and loss statement for these 38 chemical companies for the calendar years 1939 and 1940. It is interesting to observe that despite the fact that sales increased by more than $200,000,000,

and that net profits from operations in percentage of sales increased from 18.0 to 21.9, nevertheless the net return after all charges dropped from 19.1 to 16.7 percent. One of the principal reasons is, of course, the taxes which more than trebled during the year.

Comparable figures for the group of five fertilizer corporations showed that net sales increased from $67,000,000 to $75,000,000 and the net profit from operations in percent of sales rose from 2.4 to 4.2 percent.

PRODUCTION

CHEMICAL production in 1941 averaged 140 according to the new Federal Reserve Index that has for its basis 1935–9=100. This compares with 115 for 1940 and 102 for 1939. A year ago it was thought that a 10 percent increase might be effected in 1941. The actual gain was more than twice that. But to attempt to estimate where that index will go in 1942 would indeed be hazardous. However, since it is based on man-hours worked in a variety of plants, and since most chemical industries are already operating on a continuous basis of three shifts per day seven days per week, it is evident that further increases must come from new plants and expansion of present productive facilities. As evidence of the gains being made in utilization of defense plant facilities, the Bureau of Labor Statistics recently reported that since June 1941, six plants manufacturing a substantial proportion of all military explosives had indicated an increase of over 200 percent in man-hours worked per week.

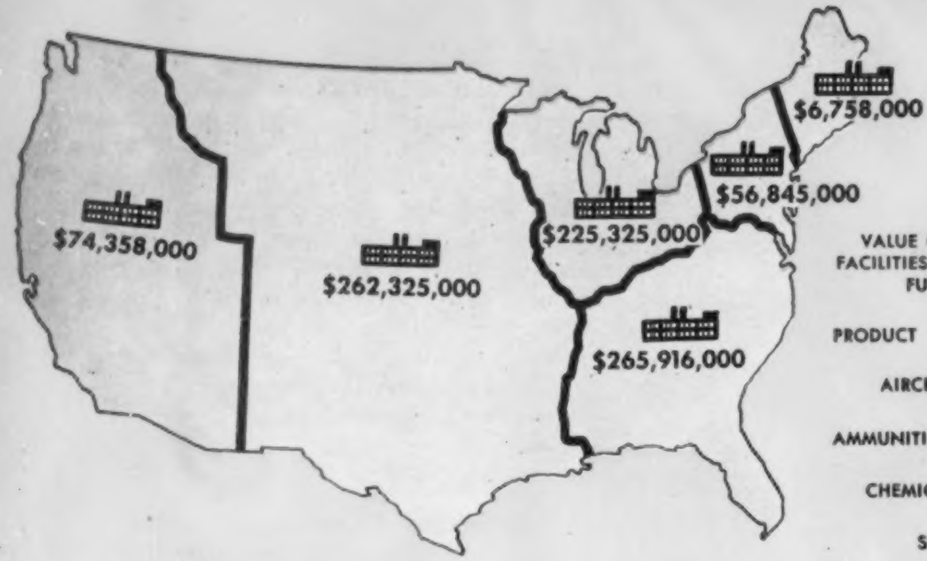
SALES

THIRTY-EIGHT chemical companies whose balance sheets were analyzed on the preceding page, reported sales in 1940 of $1,253,000,000. Applying the *Chem. & Met.* indexes of prices and consumption, it seems fair to estimate that total chemical sales in 1941 were at least $1,750,000,000.

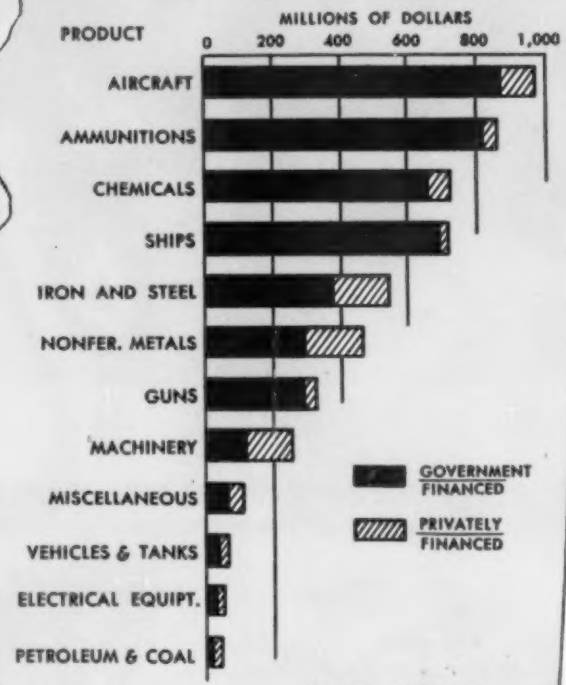
General Summary of Total Assets and Volume of Business

NAMES OF REGISTRANTS	TOTAL ASSETS (000 Omitted) 1940	TOTAL ASSETS (000 Omitted) 1939	VOLUME OF BUSINESS (000 Omitted) 1940	VOLUME OF BUSINESS (000 Omitted) 1939
Air Reduction Company, Incorporated	50,156	44,187	36,388	27,613
Allied Chemical & Dye Corporation	244,805	236,698	190,260	167,993
Atlas Powder Company	26,046	22,047	20,582	16,531
The California Ink Company, Inc.	2,252	2,535	2,876	2,518
Catalin Corporation of America	1,642	1,599	1,836	1,768
Clorox Chemical Co.	1,903	1,658	3,331	2,783
Columbian Carbon Company	31,381	30,699	16,141	15,159
Commercial Solvents Corporation	20,915	20,043	15,845[1]	14,481[1]
Consolidated Chemical Industries, Inc.	8,831	8,537	6,091	5,508
The Dow Chemical Company	48,185	41,855	37,744	26,762
E. I. du Pont de Nemours and Company	801,311	735,824	359,056	298,833
General Aniline & Film Corporation	61,984	61,493	28,211	25,803[2]
General Printing Ink Corporation	7,153	7,063	10,611	9,982
Hercules Powder Company	71,540	49,108	52,429[3]	41,010[3]
The Hilton-Davis Chemical Company	2,621	2,330	2,941	2,317
Interchemical Corporation	17,429	17,262	24,904	23,433
International Products Corporation	6,133	6,191	3,427	4,322
Koppers Company	112,166	109,944	55,633	40,121
Lac Chemicals, Inc.[4]	545	579	153	203
Lindsay Light and Chemical Company	587	1,059	879	522
The Liquid Carbonic Corporation	24,017	22,990	19,124	17,194
The Mathieson Alkali Works, Inc.	25,455	24,857	12,431	10,967
Monroe Chemical Company	1,399	1,364	666	678
Monsanto Chemical Company	54,231	54,752	45,608	42,983
National Cylinder Gas Company	10,644	6,922	7,649	4,945
Compressed Industrial Gases, Incorporated[*]	D	4,102	D	3,419
National Oil Products Company	6,581	4,740	8,275	7,729
Newport Industries, Inc.	6,309	5,671	4,736	4,573
Novadel-Agene Corporation	4,611	4,463	2,228	2,521
Parker Rust Proof Company	3,183	2,645	2,612	1,920
Pennsylvania Salt Manufacturing Co.	19,206	16,707	12,453	9,572
Union Carbide and Carbon Corporation	364,670	336,845	231,393	170,347
United Carbon Company	16,959	16,447	8,483	8,575
United Chemicals, Inc.	2,947	3,029	794	729
United Dyewood Corporation	6,850	7,887	3,303	5,380
U. S. Industrial Alcohol Co.	14,142	13,854	3,052[5,6]	11,909[6]
Victor Chemical Works	8,836	8,715	8,487	8,394
The Warren Refining & Chemical Company	184	193	219	199
Westvaco Chlorine Products Corporation	14,229	13,180	12,232	10,803
Totals# for 38 Chemical companies	2,102,037	1,945,970	1,253,082	1,047,080

#Represents thirty-eight (38) registrants. [*]Data for this registrant excluded from totals. [1]After deducting federal withdrawal tax, $27,930,318 in 1940 and $19,764,000 in 1939. [2]For nine (9) month interim period from 4-1-39 to 12-31-39. [3]After deducting freight and operating costs of distributing facilities, $3,601,874 in 1940 and an unstated amount in 1939. [4]Formerly Pacific Distillers, Inc., name changed January, 1941. [5]For three (3) month interim period from 1-1-40 to 3-31-40. [6]After deducting internal revenue taxes, $1,145,281 in 1940 and $3,960,066 in 1939.

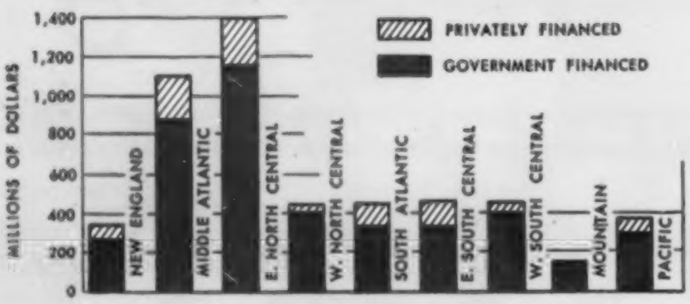


VALUE OF DEFENSE CONTRACTS FOR INDUSTRIAL FACILITIES FINANCED BY GOVERNMENT AND PRIVATE FUNDS, THROUGH SEPTEMBER 30, 1941



SOURCE:—OFFICE OF PRODUCTION MANAGEMENT

VALUE OF DEFENSE CONTRACTS FOR INDUSTRIAL FACILITIES, THROUGH SEPTEMBER 30, 1941 BY GEOGRAPHIC REGIONS



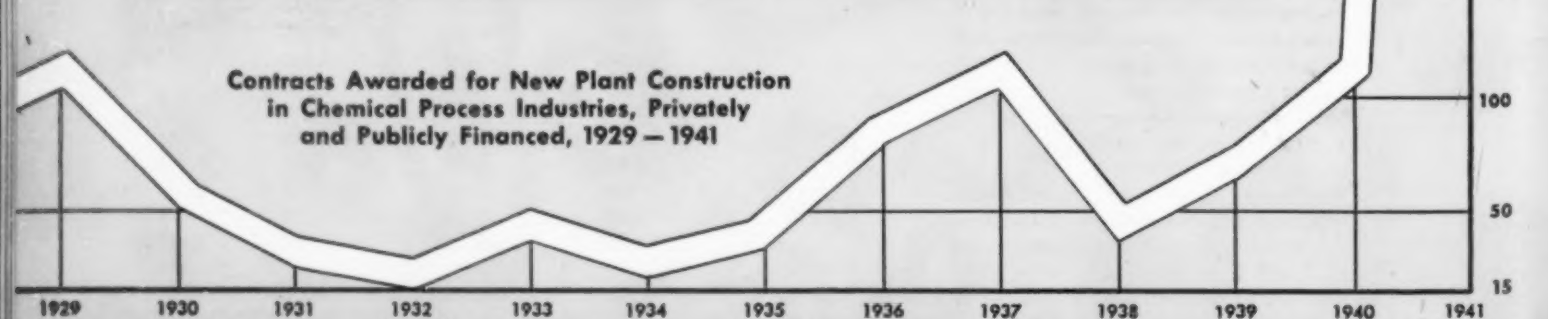
SOURCE:—OFFICE OF PRODUCTION MANAGEMENT

CONTRACTS FOR PRIVATE INDUSTRIAL BUILDING CONSTRUCTION*

(Value in thousands of dollars)	1929	1932	1937	1939	1940	1941
Railroads	......	$1.108	$2.417	$1.447	$1.827	$2.963
Automotive	$28.962	9.562	8.431	4.114	5.077	9.202
Public Utilities	151.033	22.800	70.765	94.822	121.155	86.180
Process Industries (a)	122.048	19.002	111.246	78.239	123.165	115.539
Food Industries (b)	32.138	14.385	36.248	23.049	28.292	34.263
Metal Refining and Rolling	48.920	745	111.426	22.340	66.390	52.636
Auto Factories	......	3.735	21.763	1.562	5.535	2.980
Aircraft Factories	14.818	418	4.312	11.037	137.656	40.977
Foundries	4.150	188	1.890	1.819	2.050	2.235
Machine and Machined Parts (c)	17.044	5.220	41.030	14.343	48.446	93.965
Textiles (excluding rayon)	9.705	2.047	5.017	3.714	1.931	9.418
Wood Industries	4.857	595	825	950	2.890	2.672
Miscellaneous Factories	110.311	12.646	61.511	24.744	49.065	42.634
Refrigeration and Cold Storage	3.327	613	417	800	585	780
Total	$547.313	$93.064	$477.298	$282.980	$594.064	$496.176

(a) Includes Distilleries. (b) Includes Breweries and Wineries. (c) Includes Radio Plants.

*As Reported by McGraw-Hill Construction News Services.



Contracts Awarded for New Plant Construction in Chemical Process Industries, Privately and Publicly Financed, 1929 — 1941

This does not include the finished output of the governmental plants operated by private companies for munitions production, but does reflect their requirements of chemical raw materials. Chemical exports through the first nine months of 1941 reached the record-high of $196,045,130, compared with about $220,000,000 for the entire year in 1940.

As in pervious years, the fertilizer industry continued to consume chemicals in the largest volume, although from the standpoint of value and variety, the textile industry, including rayon, is by far the most important. Pulp and paper is second to fertilizers on the volume basis, but in 1941 petroleum refining's position in third place was closely contested by both glass and paint and varnish. Plastics and synthetic resins assumed greater importance as chemical markets last year.

Publication within the past few weeks of the first results of the 1939 Census of Distribution presents information on the initial flow of chemicals from manufacturing plants to users and consumers, showing the amounts sold (1) to or through manufacturers' own wholesale branches, (2) to or through their own retail outlets, (3) to industrial and other large users, (4) to wholesalers and jobbers, (5) to export intermediaries, (6) to retailers for resale, (7) to buyers in other countries (direct export), and (8) to consumers at retail. It is interesting to observe that for chemicals and allied products approximately a third of all sales are to industrial consumers. This compares with 27.4 percent for industry as a whole. Chemical industry is also one of the largest suppliers to its own wholesale branches or offices with a total of 31.3 percent as compared with 21 percent for all groups. The average percentage of all industrial sales to retailers is 19.4 but the proportion for chemicals is only 8.7 percent.

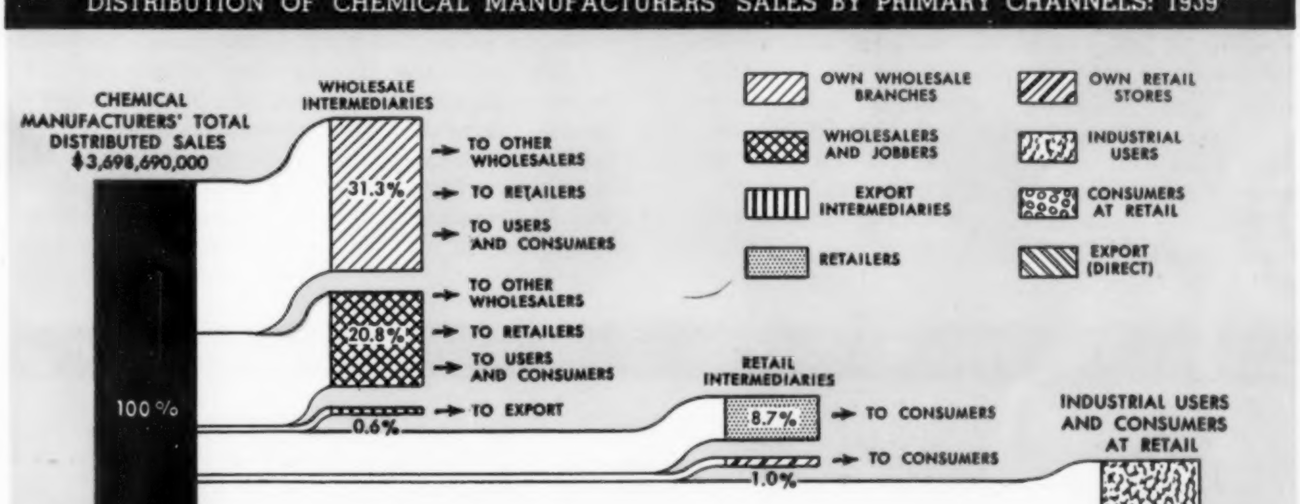
NEW CONSTRUCTION

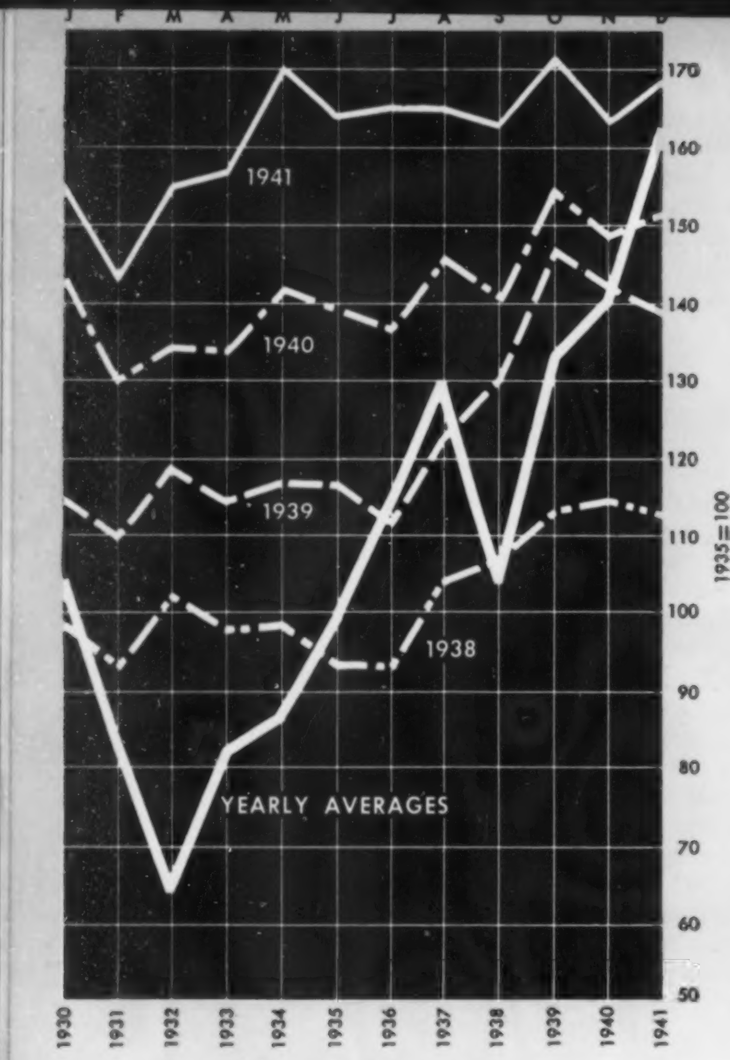
WHEN government-financed construction of production facilities for chemicals and explosives is superimposed on the total for private industrial building, the record is indeed an amazing one. As dramatically shown on the accompanying chart, the total contracts awarded in 1941 shot up to the dizzy heights of $896,205,000. That is about ten times the normal rate of new plant construction in the chemical process industries.

Contracts for private industrial building construction in the process industries dropped off slightly from the record high of $123,165,000 in 1940 to $115,539,000 last year. This decline, however, is less than that for construction as a whole and, as in recent years, the process industries led all others in factory expansion.

Again, as in recent years, the South holds the premier position in chemical plant construction. In 1941, for public and privately financed construction, the South led with 29.7 percent but was very closely followed by the area "West of the Mississippi," with 29.3 and the Middlewest, with 25.2 percent. Following in order are: the Far West, the Middle Atlantic States, and New England. In the total of $896,000,000 was $4.6 million of process industry construction in Canada.

DISTRIBUTION OF CHEMICAL MANUFACTURERS' SALES BY PRIMARY CHANNELS: 1939





Chem & Met Weighted Index of Chemical Consumption

TRENDS

CONFRONTED with abnormal demands from outside countries, with greatly expanded use of materials at home, and with a steadily growing production of military goods, chemical plants were hard pressed last year to meet the demands made upon them. In 1940, particularly in the latter part, chemical production was reported to have been on a full capacity basis, yet the 1941 volume of output ran to much higher totals.

From the standpoint of consuming industries the most important development of the year was found in the controls over distribution which, in the allocation of materials, distinguished between essential and less important end products. As these controls are given wider application under the duress of military expediency, the effects upon certain manufacturing lines will become more pronounced. While chemicals enter into practically every line of manufacture and must therefore, be affected somewhat by changed conditions, the upward trend of consumption will not be checked by whatever industry adjustments are made necessary. Military requirements are mounting as new plants come into operation. Moreover, the manufacturing lines which are the largest users of chemicals are turning out products which ordinarily come under the civilian classification but a large part of this production now finds an outlet somewhere in the military preparations and will be rated accordingly in the allocation of raw materials.

The *Chem. & Met.* weighted index for consumption of chemicals rests on 1935 as the base period. It was devised as a means by which industrial activity may be expressed quantitatively in terms of chemicals. In the last two years a large new consuming outlet has come into existence—the manufacture of military explosives. It has not been made a component of the index because data regarding such production have been held confidential. Last year the index number had risen by approximately 63 percent over the 1935 figure with the greater part of the increase recorded in the last two years. It is obvious that this rise is too large to be accounted for solely on the ground of normal improvement in domestic economy. Demand for chemicals began to rise noticeably immediately after the outbreak of hostilities abroad and has been almost unbrokenly upward ever since. The effects of war-influences were felt in this coun-

CHEM & MET'S WEIGHTED INDEX FOR CONSUMPTION OF CHEMICALS BASED ON

Industry	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Fertilizer	24.95	26.40	18.53	11.64	17.78	18.91	19.47	22.57	28.93	23.72	25.13	28.80
Pulp and paper	12.07	11.46	10.71	9.34	10.80	11.15	12.39	14.31	15.96	13.70	16.52	19.98
Glass	10.60	9.31	8.00	6.03	7.71	8.21	10.58	12.45	13.61	9.00	12.51	13.15
Petroleum	10.86	10.11	9.77	8.93	9.37	9.74	10.51	11.61	12.87	12.68	13.45	14.08
Paint, varnish, and lacquer	12.84	10.40	8.62	5.96	6.80	8.54	10.35	10.77	11.33	9.47	10.66	11.12
Iron and steel	9.13	7.53	5.56	3.10	4.46	5.43	7.20	8.00	9.21	5.87	8.21	10.54
Rayon	2.92	3.07	3.65	3.29	5.23	5.09	6.29	7.01	7.97	5.82	9.08	11.43
Textiles	7.03	5.38	5.62	5.13	6.40	5.52	6.11	7.44	7.62	6.14	7.89	8.52
Coal products	8.55	7.32	5.23	3.58	4.22	4.88	5.74	7.46	9.66	5.37	7.17	8.91
Leather	3.75	3.32	3.25	3.11	3.55	3.65	3.95	4.08	4.10	3.35	4.16	3.96
Explosives	5.89	5.17	3.97	2.76	3.04	3.74	3.62	4.60	4.71	3.89	4.53	4.91
Rubber	2.53	2.02	1.58	1.57	1.86	2.10	2.17	2.58	2.56	1.86	2.79	3.05
Plastics	.79	.78	.82	.64	.78	1.09	1.62	1.97	2.28	1.30	2.05	2.77
	111.91	102.29	85.31	65.08	82.00	88.05	100.00	114.85	130.81	102.17	124.15	141.25

IN CONSUMPTION

OF CHEMICALS IN INDUSTRY

try immediately; the dislocation of international trade centered attention on this country as a fertile source of supply for raw materials and finished products; reduction or total elimination of foreign competitive products made it necessary for us to step up production at home; and inability to secure monopoly chemicals from abroad resulted in the introduction of new domestic production. Then came the defense and lend-lease programs which had a direct bearing upon demand for chemicals. Under this combination of circumstances it was inevitable that industrial progress should be rapid.

Under our all-out war effort, production schedules are scaled on a level far above anything industry has been called upon to accomplish. The over-all effect on chemicals will be to push production and consumption to the fullest possible extent. To translate these accomplishments into industry totals is not so easy. It is apparent that munitions plants will take a high ranking among consumers. Other rated essential production will take progressively larger amounts of materials as productive facilities are made ready. How the ordinary consuming lines will fare is largely contingent upon their relative importance in the new order and upon the amount of raw materials available for their use after more important needs have been satisfied.

The position of top ranking chemical-consuming branches is fairly clear. Agriculturists have been requested to increase acreage so as to insure an adequate supply of foodstuffs. Some fears have been expressed regarding a possible shortage of sulphuric acid for acidulating phosphate rock. Changes in formulas and substitution of materials on the part of mixers also may be necessary but no serious difficulty is expected in supplying fertilizer to the full extent of requirements. The oil refining program is impressive, taking in as it does, the erection of numerous plants for production of 100 octane gasoline. Some drop in civilian use of gasoline is to be expected due to the regulations surrounding tire production and automobile distribution and use but this will be more than offset by the huge military needs. Steel mills will bring new capacity into operation this year and will consume chemicals in a large way although a larger part of output will require relatively less pickling.

All branches of the rayon industry were unusually active last year as was shown by the record outturns of filament yarn and staple. However, the steady yearly growth which has characterized the industry in recent years may be interrupted in the current year. Pulp mills, irrespective of any change in output, must reduce their takings of chlorine, and incidentally many other lines of business will be in a similar position. Textile manufacturers entered the new year at the same high rate maintained in the latter part of 1941 and while the silk branch will feel the loss of imports of the fiber, the cotton and woolen branches promise to hold production at record levels. Plastics showed a spotty picture last year with very sharp rises reported for some grades while others were limited by the scarcity of necessary raw materials. So far there is no indication that this situation will improve in the immediate future. A considerable backlog of stocks has been accumulated in the case of rubber but there is so much uncertainty regarding further importations that the control now exercised over distribution will bring about a marked curtailment in its use with a corresponding drop in call for rubber chemicals. Some compensation will be found in the plans made for large expansion of synthetic production but there is every indication that the rubber industry will lower its requirements for chemicals.

PRODUCTIVE ACTIVITIES IN PRINCIPAL CONSUMING INDUSTRIES, 1929-1941

1941												
Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
32.03	30.08	30.84	31.54	33.12	29.04	29.82	29.95	29.07	32.30	32.40	33.10	Fertilizer
20.30	20.25	22.10	22.00	22.90	22.00	21.70	22.30	22.40	22.60	22.13	22.30	Pulp and paper
14.40	13.57	14.90	15.30	15.90	15.55	14.60	15.40	14.85	15.96	15.10	14.80	Glass
14.45	13.21	14.37	14.84	15.34	15.10	15.78	15.97	15.64	15.76	15.68	16.26	Petroleum
11.23	10.94	13.05	16.86	18.96	17.64	15.90	15.79	16.45	16.60	13.43	13.00	Paint, varnish, and lacquer
12.80	12.05	13.30	12.72	13.35	13.04	13.13	13.05	12.67	12.70	12.71	13.10	Iron and steel
12.40	11.63	12.20	11.90	12.30	11.94	13.36	13.33	13.08	14.70	13.30	14.30	Rayon
10.72	10.05	10.50	11.22	11.15	10.64	11.37	11.08	10.99	12.22	10.80	12.25	Textiles
9.65	8.71	9.63	8.61	9.18	9.16	9.33	9.31	9.20	9.45	9.26	9.50	Coal products
4.70	4.58	4.74	4.60	4.85	4.92	5.06	5.04	5.00	5.20	4.80	5.00	Leather
5.26	4.91	5.21	4.67	5.53	5.76	6.02	6.03	6.00	5.96	5.47	5.70	Explosives
3.69	3.51	3.86	4.05	4.12	4.69	4.05	3.58	3.66	3.99	3.80	3.85	Rubber
3.38	3.32	3.58	3.62	3.75	3.60	3.70	3.75	3.77	4.04	3.95	4.10	Plastics
155.01	146.81	158.28	161.96	170.45	163.68	163.82	164.58	162.60	171.48	162.83	167.16	

COMMODITY REVIEWS

Sulphuric Acid and Sulphur

Sulphuric acid production during 1941 was apparently at greater-than-capacity rate, reaching a level 19 percent above 1940. This feat was accompanied by an even larger increase for acid consumption, which left producers at the year end only small stocks. Total pyrites usage declined, although domestic pyrites and smelter production were up. Sulphur took the brunt of the load, with shipments 33 percent above the record 1940.

As was to be expected, sulphuric acid production and consumption both reached hitherto untouched levels in 1941. Many acid plants operated at higher than rated capacity and the end of the year found producers with very small stocks of acid above the immediate requirements of consumers. Several unoperated chamber plants in the fertilizer industry are scheduled to go back into production, considerable new capacity is being added, and it is probable that existing plants will be pushed still harder in the coming year. One factor in the current picture requiring large quantities of acid is the building up of stocks for the new government nitration plants. Once this situation becomes stabilized, provided that every effort is made to assure efficiency in the re-use and recovery of spent acid, it is probable that reductions in civilian demand will ease the situation to the extent that capacity will not be badly strained.

Acid consumption gained materially in all consuming fields. To make this possible acid stocks, never very large, were drawn upon and an estimated 10,944,000 tons of acid on the 50 deg. Bé. basis was produced, compared with 6,585,000 tons in 1938, 8,209,000 tons in 1939 and 9,174,000 tons in 1940. The increase over 1940, it will be noted, is more than 19 percent. An interesting feature is that, whereas in recent years we have had difficulty in bringing our estimates of apparent production down as low as our estimates for consumption, in 1941 consumption outstripped production by nearly 100,000 tons, our consumption estimate having reached 11,040,000 tons, which is more than 20 percent above the earlier record level of 1940.

What the various consuming industries are believed to have taken is shown in an accompanying tabulation, in comparison with 1939 and 1940. It will be noted, as explained in the footnote, that the "chemicals" item is not directly comparable for all three years, since in 1941 the figure is lumped with direct defense applications of acid to avoid disclosure of estimates which must be withheld at the present. Among such special defense applications is the acid required to stock up military explosives plants, as well as the acid actually consumed in making such explosives. Whereas the heading, "explosives," in the tabulation for earlier years always included an estimate for a relatively small quantity of military explosives, it will be noted that the heading is now "industrial explosives," and that military explosives are no longer included in this classification.

Among the headings that are comparable for the several years, use of acid in textiles, iron and steel and other metallurgical fields, paints and pigments, rayon and cellulose film, and miscellaneous applications, took the largest jumps percentagewise. Sizable percentage increases were also registered in industrial explosives, fertilizers and petroleum refining. Only coal byproducts showed a comparatively small increase, which is explained by the fact that ammonia is already being diverted in considerable quantity from the manufacture of ammonium sulphate to shipment as ammonia liquor. Hence the increase in acid use in this classification is considerably less than the stepping up of coke plant activity.

A number of factors influencing these consumption trends should be mentioned here. It has already been noted that the chemicals plus defense heading cannot be split for obvious reasons, but it can be stated that use of acid in chemicals was larger all along the line, with the total registering a new record. Increased wool carbonizing is largely responsible for the substantial increase in textile use of acid. The other metallurgical increase reflects the enormously advanced demand for copper and its alloys, while the augmented use in the iron and steel field is in line with the record levels of operation at steel plants. A trend that should be noted is that use of acid in the pickling of steel products may decline in the coming year, perhaps absolutely, and certainly percentagewise, since the big increases in steel products will be in types where acid consumption is small, while the heavy civilian items, normally large acid users in many cases, will be much curtailed. A factor which will tend to hold acid usage up is the increase in pickling for intermediate inspections of billets, but flame de-scaling may gain at the expense of pickling, so that the trend may not be important from the standpoint of acid.

Increase in acid consumption in the manufacture of viscose products, including filament and staple rayon and cellulose film, reflects the record year which these materials enjoyed. The industry produced over 230,000 tons of viscose products. Viscose yarns increased nearly 12 percent, while staple production was more than 50 percent above 1940.

Factors accounting for the acid increase in petroleum refining included not only the increased run to stills, but also tremendous stepping up of high octane gasoline production, and the fact that there has already been some evidence that acid refining of lube oils is regaining lost ground at the expense of solvent refining, as chlorinated solvents become more difficult to secure. It is also true that a part of the export demand for lube oils has been calling specifically for acid treatment.

Two circumstances contributed to the fact that increase in acid use in the manufacture of fertilizers was slightly in excess of the gain in tonnage of these materials. One was the increase in P_2O_5 content of superphosphate, the other the fact that electric furnace phosphoric acid has been largely if not entirely diverted

Estimated Distribution of Sulphuric Acid Consumed in the United States

(Basis 50 deg. Bé.)

Consuming Industries	1939 Short Tons	1940 Short Tons (Revised)	1941 Short Tons
Fertilizers	1,970,000	2,260,000	2,500,000
Petroleum refining	1,210,000	1,260,000	1,400,000
Chemicals and defense*	975,000	1,120,000	1,790,000
Coal products	740,000	900,000	940,000
Iron and steel	980,000	1,200,000	1,450,000
Other metallurgical	570,000	640,000	800,000
Paints and pigments	520,000	580,000	700,000
Industrial explosives	160,000	170,000	190,000
Rayon and cellulose film	405,000	470,000	555,000
Textiles	116,000	125,000	165,000
Miscellaneous	384,000	460,000	550,000
Totals	8,030,000	9,185,000	11,040,000

* To avoid disclosing estimated consumption of acid in direct defense applications such as military explosives, this use of acid in 1941 is lumped with applications in chemicals.

Data and Estimates on U. S. Sulphur Activity and Sulphuric Acid Production, 1939-1941

(Sulphur and pyrites in long tons; acid in short tons, 50 deg. Bé.)

	1939	1940 (Revised)	1941
Sulphur mined	2,090,979	2,732,088	3,150,000
Sulphur exports	627,819	746,468	725,000
Domestic shipments*	1,605,998	1,812,274	2,675,000
Approx. mine stocks at end of year	4,000,000	4,200,000	3,950,000
Non-acid uses of sulphur	495,000	610,000	705,000
Sulphur available for acid	1,111,000	1,230,119	1,970,000
Change in consumer stocks	+100,000	+100,000	+500,000
Acid from sulphur	5,250,000	5,882,000	7,580,000
Pyrites imports	482,336	407,004	310,000
Change in consumer stocks	+90,000	....	....
Domestic pyrites	516,408	618,107	670,000
Acid from pyrites	1,917,000	2,162,000	2,044,000
Acid from smelters	974,000	1,050,000	1,250,000
Acid from hydrogen sulphide	68,000	80,000	70,000
Total sulphuric acid made	8,209,000	9,174,000	10,944,000
Acid reported by Census	7,649,814	....	....

* Does not include imports of about 14,000 tons in 1939; 27,774 tons in 1940; and 27,000 tons in 1941, from Trail, B. C., nor shipments of about 4,000 tons of byproduct elemental sulphur from fuel gases. Both used for purposes other than acid; not included above in "non-acid uses."

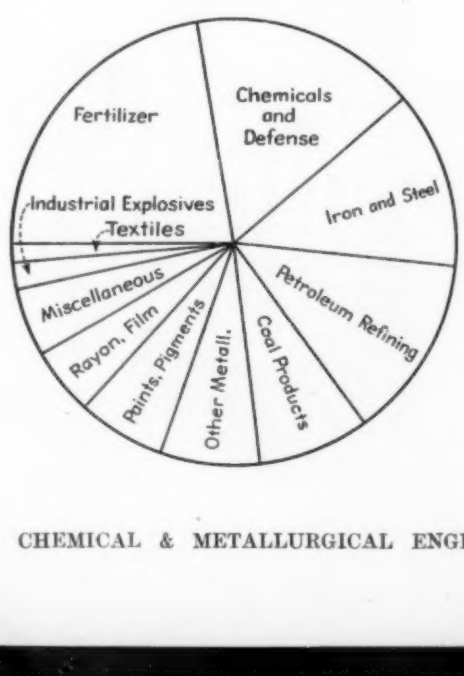
from the manufacture of triple superphosphate. Thus sulphuric acid must be used for low concentration products to replace the high strength materials formerly made.

Where the sulphuric acid came from, as well as the situation in raw materials, is summarized in an accompanying tabulation for the years 1939–1941. These data are based on *Chem & Met.* and trade estimates and on Bureau of Mines statistics. For the two earlier years sulphur mining, exports, shipments and stocks at mines, plus pyrites use and acid production at smelters, are taken from Bureau of Mines figures, while other data in the main are estimates.

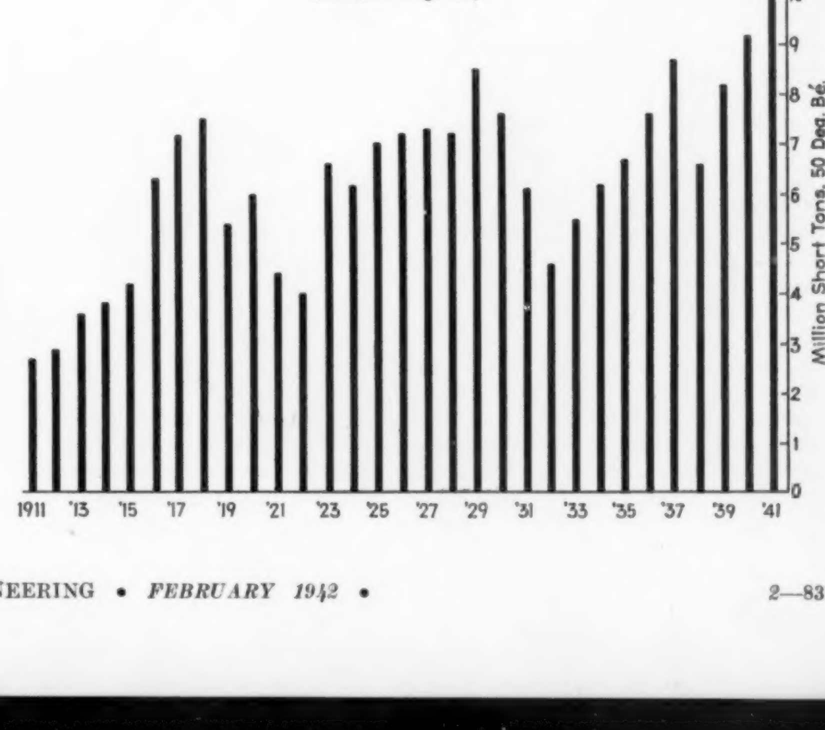
Sulphur mining, according to well-founded evidence, was much in advance of that in the largest previous year, 2,741,970 long tons in 1937. The 1941 figure of 3,150,000 long tons includes an estimate for the small California and Utah production, but does not include the elemental sulphur produced from smelter gases at Trail, B. C., nor the sulphur recovered from wet processes for coke oven gas purification. Sulphur exports were slightly below the record level of 1940, but domestic shipments were much higher, as were non-acid uses of sulphur. The shipment situation is reflected in the fact that sulphur stocks in users' hands are now at an extremely high level, in anticipation of possible transportation difficulties. Both government and producers urged the desirability of stocking at consuming points, since mine stocks were more than ample and mining rates had been pushed up to take care of any possible contingencies.

A large decrease in imports of Spanish pyrites occurred during the year, part of which was made up by increase in importations from Canada. At the same time, consumption of domestic pyrites was increased, but the total acid production from pyrites is estimated to have been slightly below that of 1940. Thus, the consumption of imported pyrites is put at only 310,000 long tons, compared

SULPHURIC ACID DISTRIBUTION-1941
(Chem. & Met Estimates)



U.S. PRODUCTION OF SULPHURIC ACID, 1911-1941
(Basis, 50 Deg. Bé)



with 407,004 long tons in 1940. The 618,107 long tons of domestic pyrites consumed in 1940 was increased to a probable 670,000 long tons in 1941. Production of byproduct acid at copper and zinc smelters increased by a considerable percentage, not only that part made from byproduct gases, which is shown, but also the part made from sulphur in these plants, which is lumped with the sulphur-produced acid made at other plants. Acid was again produced from hydrogen sulphide at a number of plants equipped to recover this gas from sour refinery gases, but it is probable that production was down slightly from that of 1940 since one of the plants used H_2S for part of the year in the manufacture of sodium sulphide.

In view of the various factors mentioned above, we estimate that the acid production of 1941, on the 50 deg. Bé. basis, was made up of 7,580,000 short tons from brimstone, 2,044,000 tons from pyrites, 1,250,000 short tons from byproduct smelter gases and 70,000 short tons from hydrogen sulphide, making up the total of 10,944,000 short tons.

(*Please turn to page* 105)

Alkalis and Chlorine

Alkalis and chlorine followed the general trend of chemical production and consumption in 1941, with increases in the range from 13 to 20 percent, and the establishment of new records all along the line. Chlorine production crowded the country's capacity, resulting in allocations and in plans for much new capacity. Soda ash and caustic capacity, however, still appear to be sufficient for any likely requirements.

ALKALI PRODUCTION in 1941 touched new high ground in nearly every department, with the possible exception of natural and electrolytic soda production. Production and consumption of most of the products of the industry increased in the range between 13 and 20 percent, as compared with 1940, which was the previous peak year. Chlorine production which established the most notable increase, reached a level about 20 percent above the preceding year. Caustic soda production, running slightly below consumption, increased about 13.6 percent over 1940. Between these extremes, soda ash production rose some 15.6 percent, with a slightly larger percentage gain for consumption.

Soda ash capacity is, of course, overwhelmingly in the ammonia soda plants of the six manufacturers using this process. With the capacity added in 1940 by two of these plants, 1941 capacity was sufficient to yield the 3,650,000 tons which we estimate was produced, with a fair margin left over for future demands. In spite of this margin, one manufacturer contemplates expenditure of some $5,000,000 on additional capacity in 1942. Not all the capacity of the industry is modern, but the part considered useful, if rated as 100 percent, establishes about 90 percent as the operating rate for 1941, a record for recent years. This production was divided, we believe, into about 3,512,000 tons of ammonia soda, 120,000 tons of natural soda and 18,000 tons of electrolytic soda. The figures compare with our 1940 estimates of 3,025,000 tons of ammonia soda, 107,000 tons of natural, and 25,000 tons of electrolytic soda.

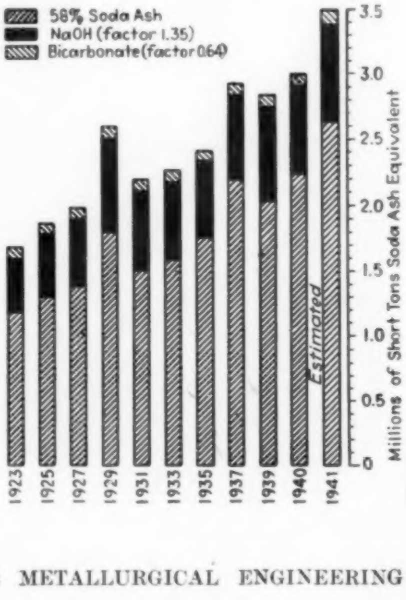
Soda ash consumption probably matched productioin closely, to an estimated total of about 3,640,000 tons, compared with 3,131,000 tons in 1940. Similarly, soda ash sales were higher in about the same ratio, that is 2,770,000 tons, as compared with 2,372,000 tons in 1940.

Although chlorine was still the ruling co-product of the chlorine-caustic soda combination in 1941, it is significant that caustic soda production gained materially over 1940 and still appeared to have been slightly less than consumption. Of the 1,250,000 tons we believe was made, about 677,000 tons or 54 percent was electrolytic, and 46 percent or 573,000 tons was made by the lime soda process. This duplicates the ratio for 1940, in which year, the lime soda product fell slightly below 1939, while electrolytic caustic established an all-time record and for the first time passed lime caustic in quantity. In 1941 caustic from both processes reached new records, so it is obvious that it was not chlorine demand alone which forced NaOH production to new heights. The apparent discrepancy between the production of electrolytic caustic noted above and that shown in the accompanying tabulation is accounted for by the caustic made in pulp mills, which is referred to in the footnote.

All consumers of both soda ash and caustic soda showed sizable increases in 1941 as compared with the preceding year. Accompanying tables give the tonnage of each material which we estimate was required by the principal consuming industries. In the case of soda ash textiles, a relatively small user, exhibited the largest percentage increase with the next largest for exports. Pulp and paper, too, and a host of miscellaneous applications increased heavily on a percentage basis but the largest users, even if lower in percent gain, still accounted for by far the largest part of the increase. Consumption of ash in glass, for example, is estimated at about 20 percent over 1940, due to the extraordinary rate at which the glass industry operated, especially in the field of containers. Soap took an estimated 15.5 percent more and the conversion of ash to caustic soda and bicarbonate, 12.4 percent. More than 10 percent rise occurred in the case of other chemicals. Only water softeners, petroleum refining and cleansers increased their consumption of soda ash by less than 10 percent.

A similar picture is presented by caustic soda. Some of the smallest users, such as textiles, vegetable oil refining, and pulp and paper showed the largest percentage gains, but the largest users, soap and rayon, were not far behind with a 21.4 percent increase for the former and 17.4 percent for the latter. Rubber reclaiming, although small in absolute quantity, was up 15 percent and will be much more in 1942. Exports and

Production for sale of principal ammonia soda products (ash equivalents)

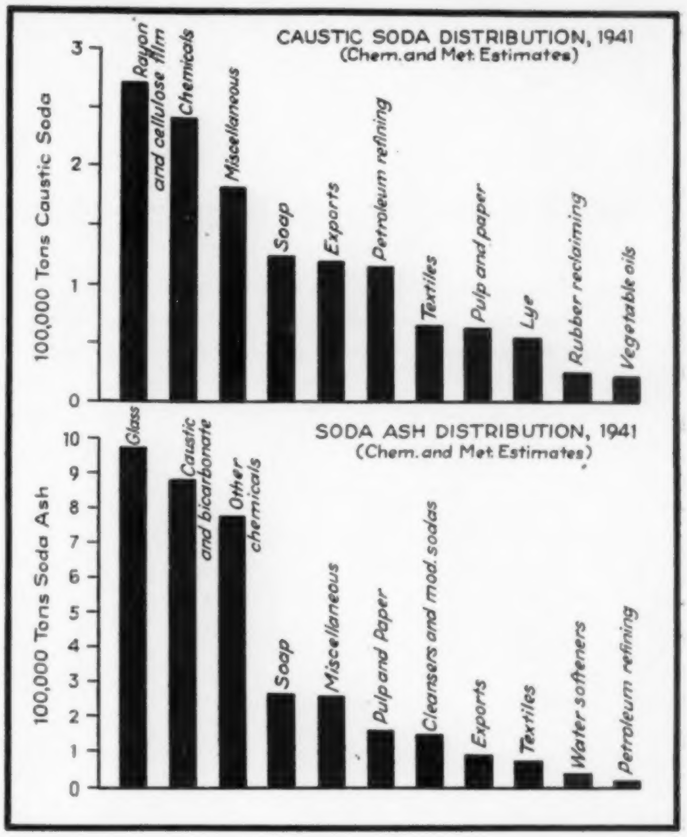


Estimated Distribution of Caustic Soda Consumed in the United States

Consuming Industries	1939 Short Tons (Revised)	1940 Short Tons (Revised)	1941 Short Tons
Soap	100,000	103,000	125,000
Chemicals	187,000	212,000	240,000
Petroleum refining	99,000	105,000	116,000
Rayon and cellulose film	196,000	230,000	270,000
Lye	44,000	48,000	52,000
Textiles	44,000	48,000	63,000
Rubber reclaiming	18,000	20,000	23,000
Vegetable oils	17,000	16,000	20,000
Pulp and paper	47,000	50,000	62,000
Exports	130,000	105,000	120,000
Miscellaneous	143,000	158,000	180,000
Totals	1,025,000	1,095,000	1,271,000

Estimated Distribution of Soda Ash Consumed in the United States

Consuming Industries	1939 Short Tons (Revised)	1940 Short Tons (Revised)	1941 Short Tons
Glass	744,000	810,000	970,000
Soap	215,000	225,000	260,000
Caustic and bicarbonate	810,000	780,000	877,000
Other chemicals	620,000	710,000	785,000
Cleaners and modified sodas	130,000	134,000	140,000
Pulp and paper	116,000	123,000	155,000
Water softeners	28,000	32,000	35,000
Petroleum refining	11,000	12,000	13,000
Textiles	43,000	45,000	68,000
Exports	80,000	58,000	87,000
Miscellaneous	164,000	200,000	250,000
Totals	2,961,000	3,131,000	3,640,000



miscellaneous uses increased in nearly a like percentage. The rise for chemicals was over 13 percent and for petroleum refining nearly 11 percent. Lye, a relatively stable product, nevertheless accounted for an estimated increase of 8 percent.

CHLORINE

Chlorine, of course, was the most spectacular actor in the alkali drama. By the mid-year, it was evident that defense requirements must come first and this chemical was shortly placed under strict allocation. Many of the uses of chlorine are directly traceable to military needs, as in tetraethyl lead, ethylene glycol and chlorinated solvents for metal cleaning. On the other hand, its use is also essential to public health for water and sewage treatment. Adequate supply has been assured for the latter use, but only at the expense of some less essential needs such as paper and certain refrigerants and cleaning solvents, for which available chlorine has been materially decreased.

Chlorine was produced at about capacity rate in 1941, or slightly below the capacity at the year-end. Production we estimate in the neighborhood of 725,000 tons, of which perhaps 605,000 tons was made electrolytically with caustic soda, while possibly as much as 120,000 tons was produced with KOH, metallic sodium and magnesium, electrolytic sodium carbonate, and by the non-electrolytic nitrosyl chloride process. Sodium capacity has recently been increased, as has the capacity of the nitrosyl chloride process. Additional chlorine will become available in 1942 from a magnesium plant operating on waste $MgCl_2$ brine produced in potash refining operations. However, it should be noted that the sea

Production of Caustic Soda in the United States

(Short Tons)

Year*	Lime-Soda	Electro-lytic	Total
1921	163,044	75,547	238,591
1923	314,195	122,424	436,619
1925	355,783	141,478	497,261
1927	387,235	186,182	573,417
1929	524,985	236,807	761,792
1931	455,832	203,057	658,887
1933	439,363	247,620	686,983
1935	436,980	322,401	759,381
1937	488,807	479,919	968,726
1939	530,907†	494,104†	1,025,011
1940 (estimated)	505,000	595,000	1,095,000
1941 (estimated)	573,000	647,000	1,220,000

* Figures for 1921–1939 are from the U. S. Bureau of the Census. Electrolytic caustic soda figures do not include that made and consumed at wood-pulp mills, estimated at about 30,000 tons in 1927 and 1929, at above 24,000 tons in 1931, 21,000 tons in 1933, 20,000 tons in 1934, 17,000 tons in 1935, 19,000 tons in 1936 and 1937, 18,000 tons in 1938, 25,000 tons in 1939, 30,000 tons in 1940 and 30,000 tons in 1941.

† Estimated. 1939 Census gives 523,907 tons of lime soda caustic and 426,250 tons of electrolytic caustic made for sale. The total of 74,854 tons made and consumed is not distributed by process. We estimate 7,000 tons of lime soda caustic made and consumed.

water magnesium process is not a net producer of byproduct chlorine, but actually is a consumer.

Since greater chlorine capacity is in the cards for the immediate future, and since power supply is becoming a critical factor in many regions, interest in non-electrolytic processes for chlorine has been extremely high in recent months. One process which has received considerable attention manufactures chlorine and salt cake by the treatment of common salt with SO_3. The version of this process which has received most attention in the press has not been worked beyond the laboratory stage, but at least two other versions have gone considerably farther and may be found feasible on a commercial scale. Still another proposal under consideration is the catalytic oxidation of HCl, made from salt and sulphuric acid. It should not be supposed, however, that considerable additional electrolytic chlorine capacity will not be installed.

Aside from the trends already mentioned, a number of other matters were of interest in 1941. In our February 1941 issue, we mentioned the possible use of soda ash as a desulphurizing agent in the steel ladle and in blast furnaces. Although the process has not yet been put to use, an A.S.M.E. committee on blast furnaces investigated it thoroughly and

reported favorably. One of the newer applications of soda ash, namely in synthetic salt cake, gained further acceptance in 1941 and is understood to have been materially increased in quantity during that period, compared with the preceding year.

Fertilizers and Materials

Gross consumption of fertilizers in 1941 was about 8 percent ahead of 1940, which means that again, as in 1940, previous records were broken. Demand for the current year is expected to be even larger, but sulphuric acid and nitrogen shortages, coupled with probable transport difficulties, may hold consumption down to last year's level. Potash capacity is a bright spot in the picture with America now self-sufficient in this direction.

Fertilizer demand in 1942 will certainly exceed the supply, even though production may approximately equal the 1941 all-time record. That record output was made up of 8.4 million tons of fertilizer marketed by commercial enterprise and 0.7 million tons distributed by the Government either for soil conservation or agronomic research. The gross consumption of fertilizer was about 8 percent grater than in 1940.

On the average the fertilizer distributed in 1941 contained close to 20 percent of plant food, which was also a record. In tonnage the plant food put on the soil was by a considerable margin the greatest in the history of this country.

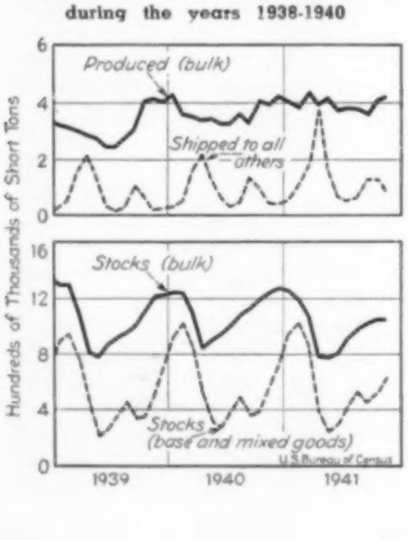
As recently as December 1 it appeared that the demand for fertilizer during 1942 would be from 5 to 10 percent greater than the record use last year. But the agricultural goals set for the farmers in mid-January still further raised the production objective and correspondingly the fertilizer demand. It appears that at least 5 to 10 percent more fertilizer will be essential readily to reach these new goals as compared with the ones which had been set late in 1941. Altogether, therefore, the demand in the United States will be 10 to 15 percent more than the record production and use last year.

To meet these demands there is plenty of domestic potash, plenty of phosphate rock, an abundance of fertilizer manufacturing capacity, and adequate skilled staff which can suffer much depletion by draft and diversion to war industry without becoming inadequate for the job. But shortages in nitrogen supply, sulphuric acid for manufacture of superphosphate, burlap bags, and certain types of transport, all seem inevitable. It will not surprise the leaders of the industry, therefore, if the actual output in 1942 merely equals last year's production. Every effort will be made to meet the demand. But the limiting factors discussed seem insurmountable in some areas for some classes of fertilizer.

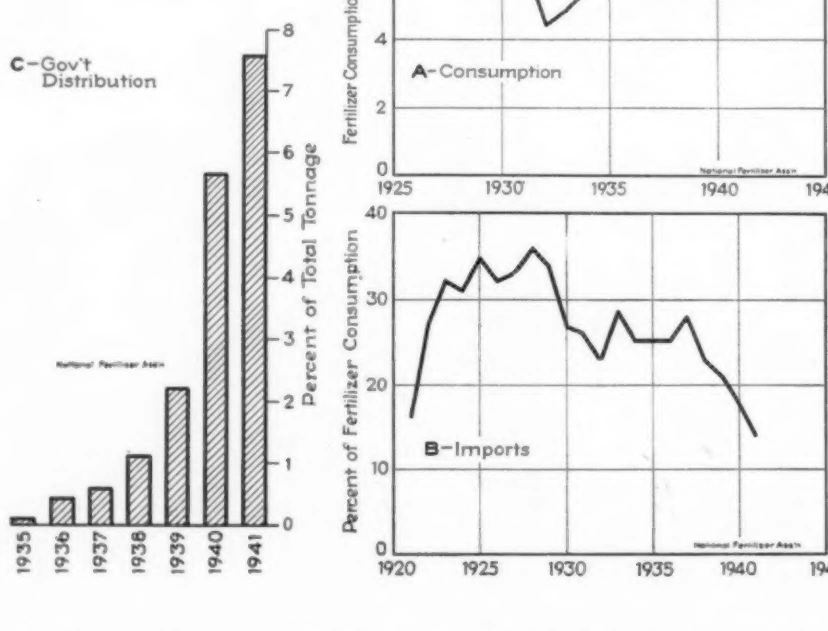
During 1941 the manufacture of sulphuric acid at fertilizer works probably exceeded all previous records. Some old plants that had been practically abandoned were put back into service. Three large new plants were just starting, or about to start, operations at the new year. Almost every chamber plant in the country where the output can be increased by that procedure has started using water cooling of the chambers. Thus, the total production of acid this year will far exceed any previous record. The question is not the quantity which can be made, but the quantity which will be left with the fertilizer man for use in making superphosphate. No one knows just how much the Army will have to take for explosives manufacture. The final decisions on that point will determine the top limit of superphosphate making during the coming year, and until the war is over.

Substantial stocks of superphosphate and mixed fertilizer are already in hand. Manufacturing is going on at peak rates throughout most of the industry. It is expected, therefore, that the supply of mixed fertilizer for Spring planting will be practically equal to the demand. There

Superphosphate in the United States during the years 1938-1940



The fertilizer picture in recent years: (A) Fertilizer consumption in the U. S.; (B) fertilizer materials imports; (C) growth of government distribution of fertilizers



may not be quite as much nitrogen in some of the mixtures as farmers would like. But the crop results expected are excellent, so far as mixed fertilizer has an influence.

Quite a different story is likely to be written regarding direct application of superphosphate and top dressing with ammonium sulphate and Chilean nitrate. The industry fears that these materials for use as separate fertilizers will not be abundantly available for many crops.

To a limited extent ground rock can be utilized as a fertilizer in place of superphosphate, but on many soils this material is practically wholly unavailable as a plant food. Only on a very few areas where the soil acidity is favorable can plants take direct from ground rock an adequate phosphate supply in the first season after application. It has been proposed, therefore, that some effort be made to prepare calcined rock for such use. However, there is only a small capacity for making this product and no likelihood that priorities would be granted for the needed equipment. Furthermore, the delivered price per unit of available phosphate in the form of calcined rock is prospectively so high as almost to prevent serious consideration of that means of relief of the shortage.

There has been some thought that possibly the Government demand for elemental phosphorus for munitions use might deplete the supply of phosphoric acid significantly. Unquestionably that effect will be noted in the field of heavy chemicals. But it is not expected to have a significant bearing on the quantity of fertilizer phosphate except high concentration "triple super," which has been made in such plants as that of TVA at Muscle Shoals. Such works which can change their furnace practice to recover phosphorus will unquestionably do so. And thus a significant quantity of these very high concentration phosphates cannot be made in the immediate future.

Transport problems of several types promise to be serious for the fertilizer industry. Movement of rock from Tennessee and Florida to acidulating plants is not only more costly, but somewhat irregular. Coast-wise ship movement has been significantly curtailed. Distribution of superphosphate and mixed goods has commonly been done very largely by truck. Shortage of tires and trucks may, therefore, greatly handicap this part of the business.

Almost no burlap bags are available because of the shortage of imported fiber. Distribution in bulk is difficult. An adequate supply of paper bags has been promised, but many plants are finding difficulty in using these since the bag filling and closing equipment suitable for burlap does not work on paper. Numerous makeshift methods for packaging and hauling are going to be necessary if the maximum production of the plants is moved promptly to points where it is consumed.

Some shifts in agricultural practice would also help greatly if they could be achieved. For example, increased corn goals could more readily be reached if the greater acreage to be cultivated were selected in the fine farm lands of the Middle West, Iowa, for example. It often takes several acres of low-grade land, for example in South Carolina, to achieve as great an increase in crop as a single Iowa acre would yield. The extra labor and extra fertilizer needed on poor land would be almost in proportion to the greater acreage required. Politics of Washington may prevent the use of so direct and sensible a plan as assigning increased acreage to places that can do the job with least work and least material. In other words, political engineering may become more important than chemical engineering or agronomy.

NITROGEN

Production of chemical supplies of nitrogen for military, agricultural, and industrial purposes placed an unprecedented load on several divisions of chemical process industry last year. Production of byproduct

United States Exports and Imports of Fertilizers and Fertilizer Materials

(Summarized by National Fertilizer Assn.)

(Long Tons)

	January-September		
Exports	1941	1940	1939
Nitrogenous materials	112,025	209,455	125,640
Phosphate rock	820,344	475,208	814,634
Other phosphate mat'ls	104,654	121,485	81,675
Potash salts	61,689	49,444	96,596
Other fertilizers	15,813	26,019	13,547
Total	1,114,525	881,611	1,132,092
Imports			
Sodium nitrate	395,541	573,403	436,261
Other nitrogenous mat'ls	240,570	241,475	367,456
Phosphate materials	69,067	65,040	73,491
Potash salts	32,588	231,534	173,872
Other fertilizers	43,518	33,737	43,295
Total	781,284	1,145,189	1,094,375

Size of Fertilizer Works

(Classification of fertilizer companies by number of wage earners employed, summarized by National Fertilizer Assn. from Census of Manufactures, 1939.)

Number of Wage Earners	Number of Fertilizer Plants	Percentage Distribution of Total Number of Plants: Actual	Cumulative
1–5	226	29.6	29.6
6–20	274	35.9	65.5
21–50	173	22.6	88.1
51–100	64	8.4	96.5
101–250	20	2.6	99.1
251–500	7	0.9	100.0
Total	764	100.0	

Plant Food Content of 1 Ton of Average Fertilizer

	1934	1939
N, lb.	95	101
P_2O_5, lb.	182	183
K_2O, lb.	90	105
Total, lb.	367	389
Total, percent	18.35	19.45

Fertilizer Material Used in United States, Fertilizer Year 1940-41

(Short tons: estimates by Synthetic Nitrogen Products Corp., for continental U. S. only)

	Total Material	Plant Food: N	P_2O_5	K_2O	Applied* Directly
Sulphate of ammonia	567,000	116,700	....	....	140,000
Nitrate of soda	783,000	125,600	....	....	668,000
Byproduct ammonia liquor	35,000	8,500	....	....	....
Synthetic N-containing solutions	101,000	50,300	....	....	3,000
Cyanamide	124,000	26,600	....	....	89,000
Calcium nitrate and urea fertilizers	43,000	15,600	....	....	9,000
Ammonium phosphates	48,000	7,200	12,200	....	28,000
Nitrate of soda-potash	22,000	3,100	....	3,100	18,000
Other potash materials	790,000	....	....	413,400	90,000
Cottonseed meal	160,000	9,600	4,000	2,700	120,000
Other natural organics	650,000	32,000	26,000	5,300	150,000
Bulk superphosphate	3,400,000	....	674,100	....	†700,000
Basic slag	40,000	....	4,300	....	40,000
Bones, bone meal, etc	90,000	2,100	21,100	....	60,000
Ground phosphate rock	140,000	....	5,600	....	100,000
Sulphuric acid (for acidulating certain organics)	5,000	....	....	....	....
Wood, beet root ashes	9,000	....	....	400	5,000
Dolomite, limestone	350,000	....	....	....	....
Other secondary plant food materials	7,000	....	....	....	5,000
Mg-containing materials	10,000	....	....	....	....
Filler	810,000	....	....	....	....
Total tonnage	8,175,000	397,300	747,300	424,900	2,225,000

*Materials not used in mixed fertilizers; includes materials used in home-made mixtures except liming materials and gypsum.

†Includes about 20,000 tons of "basic lime phosphate." Does not include triple super distributed by T.V.A. and A.A.A.

ammonia at coke and gas works achieved an all-time high. Production of synthetic nitrogen, both at industrial plants and at the military establishments financed by the Government, exceeded several-fold the normal peacetime output of recent years. Details are, of course, of military significance and cannot be reported at this time.

The record demand for fertilizer last year, and the still greater demand anticipated in 1942, will not be fully satisfied by ammonia or other nitrogen carriers. Obviously, some sacrifice must be made at this point in order that the more pressing needs of industry and explosives making be cared for. This effect was not very great last year as only occasionally were slight shortages experienced. It is hoped that the Spring manufacture of fertilizer can be largely, if not wholly, completed before extreme shortage in ammonia is experienced.

The real difficulty in agricultural nitrogen supply will come a bit later in the year. It will take two forms. There will not be enough Chilean nitrate or ammonium sulphate for top dressing of crops. And during the Spring or early Summer the synthetic and byproduct plants will not be able to ship enough anhydrous ammonia or liquor for direct ammoniation. Thus, the actual technical process of quick-cured superphosphate will have to be changed in some plants and perhaps in many.

The accompanying table, which presents the fertilizer chemicals picture, relates to the last fertilizer year, which ended June 30, 1941. Contrary to custom, *Chem. & Met.* will not present any estimates more up-to-date, nor any forecasts. Figures of this character are reserved for delayed publication, or in some cases, will remain confidential for the period of the war.

Previously in these pages there has been summarized statistically the earlier part of the effort made to expand both civilian and military establishments synthesizing ammonia directly from the air. That program is continuing at a very gratifying rate. Unfortunately, however, the frequent multiplication of military demand always seems a bit ahead of available supply. This is true primarily because it takes so many months to get heavy forgings and other special equipment required for catalyst chambers and for gas handling in this very distinctive type of chemical engineering works.

There is an abundance of Chilean nitrate available in Chile, but it is not practical at the present time to allocate boat space for prompt transport of quantities which would be welcome both in agriculture and for military usage. At this time it is difficult for anyone to guess the extent to which more imported nitrate can be made available. It is obvious, however, that it will be used in significant quantities to relieve both fertilizer and explosives deficiencies.

Under the date of January 15 the program of allocation of sodium nitrate was begun. This assigns certain preferences and restricts deliveries for purposes deemed less important at present than explosives manufacture. Effective February 1 no sodium nitrate could be delivered without specific authority of the Priorities Division and the quantities available for agricultural and other civilian uses were restricted. Comparable rules of distribution in a formal way were not undertaken as soon on other nitrogen materials. But an equivalent result was had by voluntary cooperation with the Government by producers of byproduct ammonium sulphate and synthetic ammonia and its derivatives.

POTASH

United States producers of potash chemicals made and shipped during 1941 materials containing more than 510,000 tons K_2O. At the end of the year productive capacity of these American plants was such that 600,000 tons per year of K_2O could be included in the high-grade refined chemicals which can now be produced. In addition, there is mining and milling capacity to make additional tonnage of low-grade fertilizer salts, most of which carry about 25 per cent K_2O.

America is now independent of foreign sources of potash. Industrial and fertilizer users can be generously supplied and this country can take care of insular territories and its customers in Canada and Latin America. This is true even though 1942 will probably impose all-time record demands for industrial potash and for potash chemicals to be used as fertilizers.

The accompanying tables tell the story of the 1941 operations and the prospective 1942 business. The two charts demonstrate clearly the rapidity of growth by which American enterprise has built up to these levels. It is important to note that the consumption of potash in salts has grown even faster than the consumption of fertilizers themselves. This latter fact is undoubtedly the response of American agriculture to the educational work of American Potash Institute.

Potash Statistics Based on Reports or Estimates by American Potash Inst.

Shipments of Domestic Potash Materials

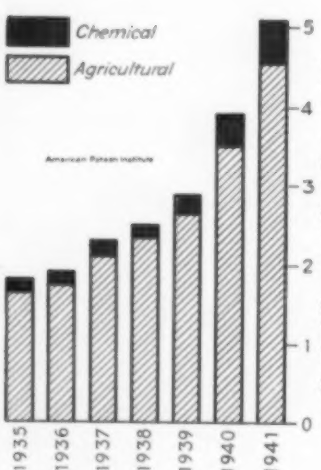
	Tons K_2O 1941 (est.)	1940
Muriate	445,000	366,000
Manure salts	30,000	4,500
Sulphate (including potash-magnesia)	35,000	19,500
Total	510,000	390,000

Estimated Demand for Refined Salts, 1942

	Tons K_2O
Agricultural demand	up to 500,000
Chemical demand	65,000
Export demand	
Canada	25,000
Cuba and other Western Hemisphere	10,000
Total	600,000

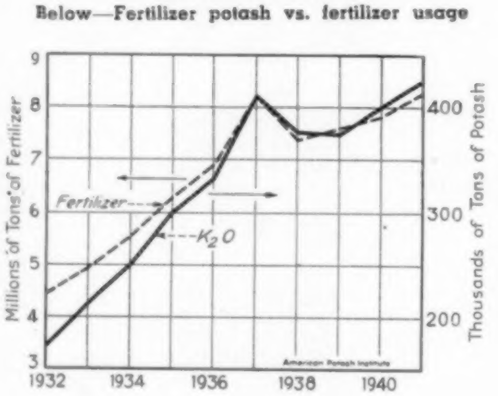
Potash Chemicals Production by Types in U. S., Fiscal Year Ending May 31, 1941

	Tons of K_2O	Percent of Total
60 percent salts	303,896	70.2
50 percent salts	91,467	21.1
30 percent salts	2,928	0.7
25 percent salts	4,899	1.1
20 percent salts	3,470	0.8
Sulphate	24,274	5.6
S.P.M	1,890	0.5
Total	432,824	100.0



Left—Distribution of potash between industry and agriculture, 1935-41

Below—Fertilizer potash vs. fertilizer usage



Natural and Synthetic Rubber

War in the Far East put a stop to the importation of raw rubber and made it necessary (1) to take an inventory of the present supply of natural rubber, (2) to consider the possibility of increasing the amount of rubber to be obtained by reclaiming old automobile tires, etc., and (3) to increase facilities for the production of synthetic rubber.

In normal times approximately 600,000 tons of natural rubber was used in a year in the United States, but in 1941 the consumption jumped about 33⅓ percent. Approximately 98 percent of this rubber was imported from the British Malaya and the Dutch East Indies. From no other region can we get more than a small fraction of this country's requirements.

Reclaimed rubber is the greatest emergency source. Operating at full capacity, the industry now is reclaiming at the rate of 270,000 tons a year. It is indicated that in the neighborhood of 500,000 tons of scrap rubber could be collected annually for a time. This would produce an equal tonnage in reclaimed rubber, but additional reclaiming plants would have to be built to take care of any amount, and its quality is reduced with each reclaiming.

The rubber consumption in the United States has been for the following uses:

	Percent
Truck and bus casings and tubes	37.9
Passenger car casings and tubes	33.8
Industrial goods	11.6
Footwear	3.3
Other tires and tubes (airplane, etc.)	3.0
Drug sundries, medical and surgical	0.8
Miscellaneous	7.2

Synthetic rubbers can be divided into several classifications (1) polymers of chloroprene (neoprenes), (2) reaction products of alipatic dihalides with alkali polysulphides (Thiokols), (3) co-polymers of butadiene with other polymerizable compounds (Perbunan, Buna S, Ameripols, Hycars, Chemigum), (4) plasticized polymers of vinyl chloride (Koroseal), (5) Polymers of isobutylene (Vistanex).

While several of these types of synthetic rubber could be substituted for the natural material in many industrial applications, nevertheless there are other uses such as tire treads for which some of these products would not be satisfactory. The most satisfactory substitutes for the large volume applications are the butadiene type rubbers and neoprene.

American synthetic rubber production in long tons is as follows, according to E. R. Bridgwater, E. I. duPont de Nemours, (see *Chem. & Met.* p. 139, Oct., 1941).

Year	Neoprene	Butadienes	Polysulphides
1939	1,750	None	500
1940	2,500	60	700
1941	6,300	4,000	1,400

The 1942 production will be much greater as an expansion program has been underway for some time. It is expected that 19,200 tons of neoprene and 18,000 tons of polyvinyl chlorine will be produced. The federal government authorized four plants (Hycar, Goodyear, U. S. Rubber and Firestone) in which it was expected that 60,000 tons would be produced, however, subsequently, it has been stated that this production will be greatly enlarged. It is possible that the country can achieve the 100,000-ton production rate before the end of 1942.

The Hycar Chemical Co., jointly owned by the B. F. Goodrich Co. and Phillips Petroleum Co., was organized in July, 1940, and during the past year constructed a plant for the production of the butadiene type of rubber (Hycar). Under terms of the contract with the Defense Plant Corp., $4,000,000 was made available for construction of the plant which was to have a capacity of 15,000 tons annually. Also during the year the company enlarged its original plant so as to produce at the rate of 7,000 tons per year.

Goodyear Tire & Rubber Co. commenced construction of a plant for the governmental agency at a cost of $4,000,000 which would provide 15,000 tons of rubber of the copolymer of butadiene type (Chemigum). The U. S. Rubber Co. likewise joined the program with a plant of similar size. And Firestone Tire and Rubber Co. erected at Akron the fourth plant in the group.

In April, the $3,000,000 synthetic rubber plant of Standard Oil Co. of New Jersey produced its first Buna rubber. Shortly afterwards it was announced that an expenditure of $15,000,000 would be used for expansion. The plant would have an annual capacity of 15,000 tons of which 5,000 would be of the butyl type, made from butadiene and isobutylene.

E. I. duPont de Nemours & Co. has constructed a new neoprene plant at a cost of $10,000,000. This company also increased the capacity of its original neoprene plant. The B. F. Goodrich Co. constructed an additional plant for the manufacture of the synthetic thermoplastic material polyvinyl chloride.

Product	Aug., 1941 Price
Natural rubber	$0.23
Neoprene GN	0.65
Buna S	0.60
Purbunan	0.70
Thiokol F	0.45
Vistanex	0.45
Koroseal (30% plasticizer)	0.60 (est.)
Hycar	0.70

As reported by H. I. Cramer, Sharples Chemicals, Inc., Philadelphia, (see *Chem. & Met.*, p. 150, Jan. 1942).

Plants were completed or under construction for the production of the principal raw material, butadiene, to be used for the manufacture of rubber by Carbide & Carbon Chemicals Corp.; Phillips Petroleum Co., Shell Oil Co., Standard Oil Co. of La., Monsanto Chemical Co., Humble Oil, The Texas Co., and others.

On Jan. 12, 1942, Jesse James announced that the Defense Plant Corp. would spend $400,000,000 to increase synthetic rubber production to 400,000 tons a year. He stated that the four plants already contracted for by R.F.C. were designed to produce 60,000 tons of rubber a year. The additional facilities to expand production to 400,000 tons should be in operation by the middle of next year. The program would include most of the major rubber and oil companies already working in the field, as well as duPont and other chemical companies.

"Pooling of patents, resources, experience and technical skill by the rubber, chemical and petroleum industries, should make possible successful attainment of the nation's 400,000-ton synthetic rubber program," according to Dr. E. R. Weidlein, chief, Chemical Branch, War Production Board, formerly Office of Production Management.

"Enough raw materials are now in sight for half the proposed program. They will be provided largely by the chemical industry. Basic ingredients for the "Buna S" type synthetic rubber adopted as a standard are

butadiene and styrene. Butadiene is produced from petroleum, natural gas, alcohol or acetylene. Styrene is a byproduct of the coke industry, coming from benzol. Some twenty other chemicals are needed for the production of synthetic rubber, but the quantities used are small and present no large production problems," said Dr. Weidlein.

The entire program is expected to result in the construction of about twenty new plants, both for raw materials and finished products.

Mr. Jones stated that he expected that the synthetic rubber which would be made largely from butadiene would cost about 30 cents a pound, which compares with the price of 22½ cents for natural rubber. Another has estimated the cost of this type of rubber produced on a large scale at 25 cents a pound, with a possible variation of 5 cents either way. This estimate includes changes for depreciation of buildings and equipment. At present it is estimated that the labor, both skilled and unskilled required for the synthetic rubber program would probably be in the neighborhood of 150,000 persons.

The Rubber Reserve Co. and the rubber industry now have on hand or afloat about 600,000 tons of raw rubber. With care and prudence in the use of rubber for all purposes, Mr. Jones stated that this supply of natural and synthetic rubber could be made to meet vital needs until the new program was completed.

Plastics

All records were broken in production figures for plastics in 1941, and undoubtedly they would have been much larger for certain members of the group, had it not been for a shortage of chemical raw materials due to the urgent need elsewhere in the defense program. As the year progressed there was an acceleration in the rate of change from peacetime to wartime application.

Plastics have had an opportunity to play two important roles in the defense program as was predicted a year ago. They have been used in the construction of airplanes and for hundreds of other applications for the Army and Navy, and they have been employed in consumer products in order to free strategic metals badly needed for construction of war plants and for building airplanes and other weapons. Plastics have made an enviable record which might have been even better if there had not been a shortage of many of the chemical raw materials.

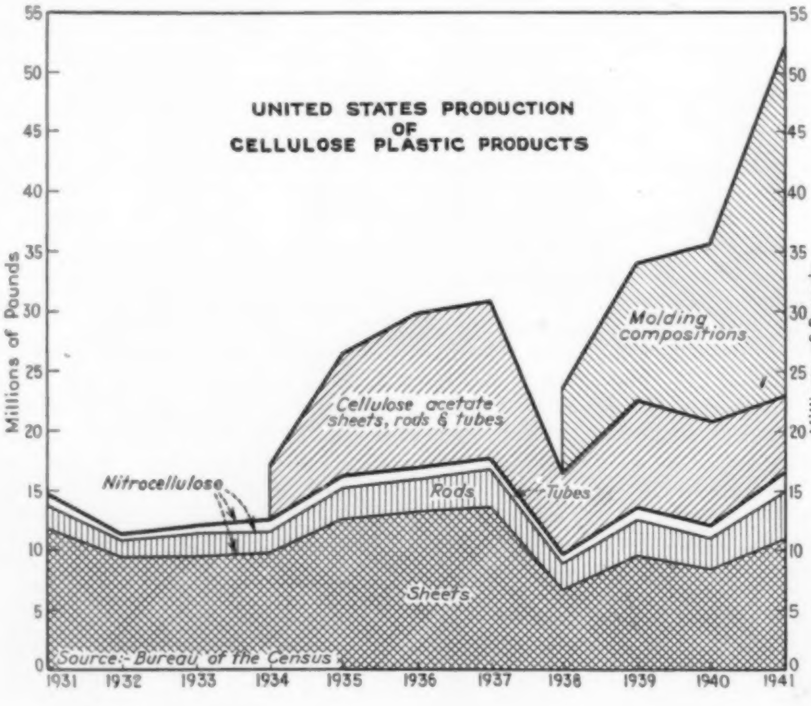
One of the outstanding features of the year has been the tremendous increase in production of cellulose acetate molding powder. 30,716,617 lb. (includes both cellulose acetate and cellulose acetate butyrate) was produced in 1941 as compared to 14,962,813 lb. in 1940 and 11,654, 920 lb. in 1939. However, there was a falling off in the demand for sheets, rods and tubes. 6,384,128 lb. was produced compared to the 8,887,238 lb. in 1940, and 9,140,907 lb. in 1939. This falling off in the latter classification is probably due to a decrease in the use of acetate sheeting in safety glass.

Cellulose acetate and acetate butyrate experienced an extraordinary demand during the year from the sharp increase in industrial activity. The excess demand made it necessary to place all customers on an allotment basis.

One of the most important developments in 1941 was the rapid increase to volume production of extrusion molding, the extruded products being used in women's belts, hand bags, furniture molding, and other applications. Extruded acetate was also applied to coarse fibers and threads which subsequently were woven into attractive braids and fabrics for such things as wrist watch bands, suspenders, belts, millinery and dress trimmings, and other articles. An interesting development is the blowing of cellulose actetate and cellulose acetate butyrate. Some publicity was given to ornamental Christmas tree balls.

A new use for cellulose acetate butyrate is as a gel lacquer, made by dissolving this material in appropriate solvents. A gel lacquer is one which is made sufficiently fluid for application by heating it; it becomes semi-hard on cooling to room temperature. A surface coating applied by dipping in such a lacquer hardens initially due to its thermoplasticity. Ultimate hardness is secured after the solvent has evaporated. Thermoplastic hardening with some loss of solvent, which occurs within about a minute on exposure to room temperature, is sufficient to prevent marring the surface by ordinary handling. The primary advantage is that thicker coatings are obtainable in a single coat than from regular lacquers.

Hercules Powder Co. has steadily



increased its capacity for production of flake cellulose acetate since it entered the field five years ago. Last year a further increase was made.

The base price of cellulose acetate molding powder is 44 cents per lb. unchanged from a year ago. Current price for cellulose acetate butyrate molding composition is 49 cents per lb.

Nitrocellulose made a comeback last year when the ten manufacturers reported producing about 16,497,019 lb. in sheets, rods and tubes. The trend has been downwards for some years. Production reached a peak in 1923 of about 27,700,000 lb. By 1937 it had dropped to 18,100,000 lb., in 1939 to 13,373,000 lb. and in 1940 to 11,915,290 lb.

The rapid expansion in use of ethyl cellulose has doubled the production of this material during the past year. An important outlet has been in insulating lacquer for high tension cable. Substantial quantities are used in lacquers and adhesives in competition with rubber, and in injection and extrusion molded plastics. Its dimensional stability and toughness at extremely low temperatures are particularly useful in plastics.

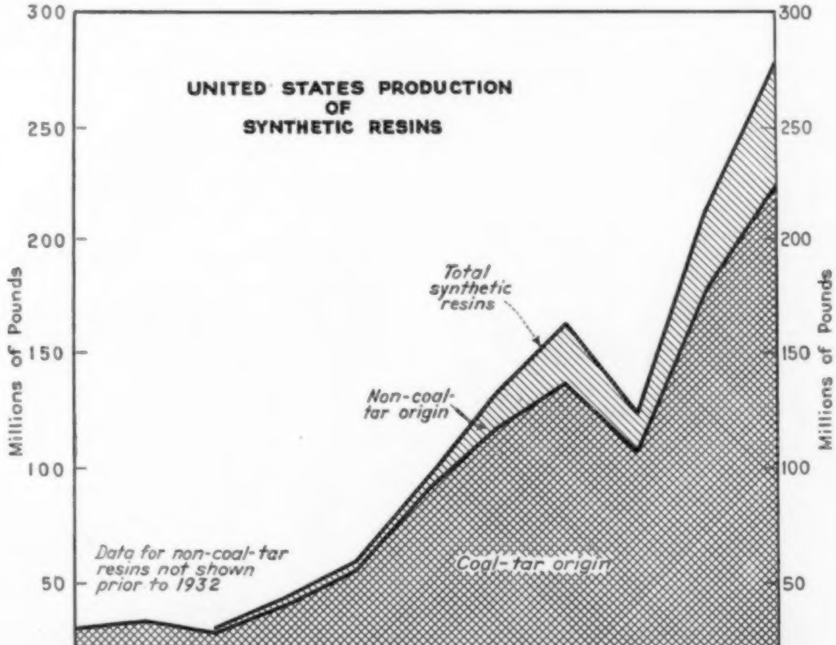
Hercules produces the material from which a plastic can be made and Dow offers an ethyl cellulose molding plastic. In 1941, the base price on ethyl cellulose for converting into molding compound was advanced from 45 cents to 50 cents per lb.

The vinyl resins as a group have increased rapidly in popularity. The group consists of polyvinyl chloride, polyvinyl acetate, the copolymer vinyl chloride and vinyl acetate, polyvinyl acetates and polyvinyl alcohol.

Synthetic resins: United States Production and Sales in 1940

Source: U. S. Tariff Commission

Resin	Production	Sales: Quantity	Sales: Value	Sales: Unit Value
(A) COAL-TAR				
Alkyd:	Pounds	Pounds		
Maleic anhydride	6,476,883	5,418,875	$1,008,835	$0.19
Phthalic anhydride	91,446,195	42,400,005	7,774,730	.18
Coumarine and indene	24,131,733	22,976,705	1,576,907	.07
Tar acids:				
Cresols or cresylic acid	11,978,763	....	....	.....
Phenol:				
For casting	6,953,103	6,696,008	3,175,589	.47
For molding	26,417,693	25,117,472	7,869,678	.31
For other uses	26,957,636	24,234,563	4,822,729	.20
Phenols and cresols	21,126,005	....	....	.....
Total coal-tar resins	222,953,118	153,520,805	33,378,406	.22
(B) NON-COAL-TAR				
Urea	21,491,653	19,300,685	7,445,483	.39
Total non-coal-tar resins	53,871,245	47,578,845	25,989,933	.55



Carbide and Carbon Chemicals Corp. is a leading producer of polyvinyl chloride and its copolymers. E. I. du Pont de Nemours & Co. and Shawinigan Resins Corp. together with Carbide and Carbon, produce all the polyvinyl butyral consumed in the manufacture of safety glass. During the past year about 99 percent of all safety-glass made in this country contained this resin. It will be hit by the order to cease making passenger cars, but some resin will go into safety glass for airplane windows.

B. F. Goodrich, and Carbide and Carbon make the polyvinyl chloride resins. Production facilities were considerably increased to meet the requirements of the federal government. With a plasticizer, this material can be used as a substitute for rubber and is generally classified among the synthetic rubber compounds.

The copolymer of vinyl chloride and vinyl acetate are being used extensively in the aircraft industry and plant facilities were increased last year and are at present being further enlarged to meet these increased requirements. The copolymer of vinyl chloride and vinyl acetate in large lots sells at 68 cents to 48 cents per lb. The polyvinyl acetate sells at 40 cents per lb. and the polyvinyl chloride at 48 cents per lb. The polyvinyl butyral brought a price of $1.25 per lb.

Vinylidene chloride plastics were introduced late in 1940 by Dow Chemical Co. Their outstanding characteristics are chemical resistance, high tensile strength and toughness. They have a wide transparent color range and are resistant to water and chemicals. They have been used for transportation seat covers, woven and braided tapes, fishing leaders, lines and snells, belts and suspenders, novelties, wrapping tapes, and other applications.

In 1941 the Barrett Co. and the United Gas Improvement Co. commenced production of styrene monomer recovered from the light oils of the byproduct coke industry, and Dow and Monsanto increased their styrene and polystyrene production facilities. To Bakelite and Monsanto has been added a third producer of polystyrene resins, during the year Catalin Corp. came into the field when their new plant was completed.

Towards the end of the year the industry was handicapped by a shortage of the raw materials, conse-

(*Please turn to page* 108)

Alcohol and Solvents

With regular consuming industries sharply raising their requirements and large amounts required for government activities, the chief consideration in the alcohol market was one of supply. Productive capacities underwent expansion and a record output was attained yet supplies were limited and a part of distilling facilities were called upon to produce alcohol from grain. In the latter part of the year distribution was on priority basis.

Production of ethyl alcohol last year not only surpassed the previous high reached in 1940 but did so by a wide margin, the increase in output being about 40 percent. In the latter part of 1940, consuming demand for alcohol had risen to a point where it was necessary to work plants at close to capacities. Last year consumers steadily pushed up their requirements and with the exception of February, progressively larger outputs of alcohol were reported for each month of the year. This was made possible by adding to plant capacities. Early in the year, one fermenter bought and put into operation an old plant which added 40 percent to the company's production. Another company opened a plant in New Orleans for the fermentation of butyl alcohol and reopened a plant at Yonkers which had been idle for some time.

In addition to expanded call for denatured alcohol which followed the rise in general activity, withdrawals of the tax-paid product gained about 25 percent over the 1940 totals and about 15,000,000 proof gal. more than in the preceding years went to the United States and its subdivisions. As the year advanced it became clear that a shortage of alcohol threatened and some distillers were authorized to turn their equipment over to alcohol production. When our status changed to an all-out war effort, military requirements were moved up sharply and plans were set in motion to meet the revised consuming requirements. Two new synthetic plants will come into operation within the year and are expected to contribute about 20,000,000 gal. In order to insure the fullest possible supply from existing and adaptable equipment, distillers have been ordered to cut their production of whiskey and produce ethyl alcohol for government use so as to release at least a part of the facilities of regular alcohol producers for the manufacture of the various grades of denatured alcohol.

Production of denatured alcohol last year also was of record proportions with the 11 months totals amounting to 159,469,524 wine gal. compared with 122,018,222 wine gal. for the corresponding period of 1940. Of the 1941 total, 143,500,624 wine gal. consisted of specially denatured grades and 15,968,900 wine gal. were completely denatured, compared with 105,413,425 wine gal. and 16,604,797 wine gal. respectively in 1940.

Prices for denatured alcohol were firm in the first quarter as the heavy demands in the latter part of 1940 had forced producers to cut deeply into their supplies of blackstrap molasses and there was much uncertainty about replenishing these stocks. It had been anticipated that molasses would be scarce in the latter months of the year but a shortage developed much sooner than had been expected. In addition to the relatively small stocks at primary points, it was difficult to obtain tankers for transporting to this country. One producer of alcohol experimented with moving molasses from Cuba by barge but this did not prove satisfactory. The temporary closing of one plant because of labor troubles added to the firmness of the market because this producer held a government contract and when unable to make delivery, other plants had to step into the breach and dip into their stocks in order to fill the pressing government demands.

The rising call for alcohol on the part of industry and government created conditions which resulted in an increase in prices in the second quarter. Incidentally the initial poor recovery of alcohol at powder plants may be cited as a factor of price importance. Sales schedules underwent another upward revision around the middle of the year under the influence of higher production costs and sharply increased consumer demand including a very substantial order placed under the provisions of the Lend-Lease policy. These conditions also were responsible for the issuance of alcohol order M-30 which went into effect on August 28 and put deliveries of alcohol on a priority basis. In October, permission was given to one producer to increase his price for alcohol from 24c to 29c a gal. and to another to advance his price from 24c to 50c a gal. In order to hold prices within bounds and to prevent speculation in molasses and sugar, the RFC purchased the entire surplus Cuban output of these commodities and placed a price ceiling on alcohol of 50c a gal. basis 2B. Prior to this action the situation had grown so acute that some jobbers were reselling alcohol and other solvents at very high prices so a meeting was called by the Price Administrator and ceilings were set on alcohol and other solvents for the remainder of the year. Also it was announced

Comparative Statistics for Ethyl and Denatured Alcohol

	1941 Jan.-Nov.	1940 Jan.-Nov.
	Proof gallons	
Ethyl Alcohol		
Produced	337,040,937	239,657,589
Withdrawn tax-paid	29,334,973	23,160,926
Withdrawn tax-free		
For denaturation	287,682,497	216,113,449
For hospital, scientific, and educational use	2,001,706	1,918,810
For use of U. S. and subdivisions	15,781,603	1,146,709
For export	635,882	125,771
In Puerto Rico	390,361	476,019
Stocks in bonded warehouses	8,037,966	10,018,410
Denatured Alcohol		
Completely denatured alcohol	Wine gallons	
Produced	15,968,900	16,604,797
Removed	16,272,405	16,376,284
Stocks, Nov. 30	137,197	516,516
Specially denatured alcohol		
Produced	143,500,624	105,413,425
Removed	143,762,280	105,163,788
Stocks, Nov. 30	586,355	1,069,005
Bonded dealers in specially denatured		
Received from denaturing plants	4,036,129	3,042,611
Disposed of to manufacturers	4,278,806	3,054,124
Inter-dealer shipments	37,775	26,714
Stocks, Nov. 30	184,626	296,551

that large whiskey distillers would make alcohol from AAA grain on a cost plus basis so as to relieve the shortage.

ACETONE

The market for acetone during 1939 and 1940 was inclined to be spotty. In 1941 the demand was so great that all producers sold their output regardless of competitive conditions. Although the end of the year witnessed the unusual condition of each producer selling at his own price level, all reported a backlog of orders and no inventory.

Although production of acetone was practically double the amount produced during the 1937-1939 period, the increased industrial demand, plus very substantial Lease-Lend demands, indicate that all existing facilities will be taxed during 1942 and it may be necessary to divert isopropyl alcohol now going into other uses in order to increase the production of acetone. During the year, two of the synthetic producers increased their facilities, but this increase was not sufficient to change the statistical position of the market.

HIGHER ALCOHOLS AND ACETATES

Due to the increased demand for automobiles, furniture, as well as military equipment, consumption of protective coatings increased so substantially that the market for higher alcohols and acetates showed an abnormal demand. In contrast to other years, the demand for butyl alcohol and acetate was greater than the supply during the entire year. As is always the case in a rising market, there was a heavy backlog of orders carried over from 1940 and the industry was never able to get far enough ahead of these orders to obtain any surplus so that many suppliers waited for the delivery of their orders for the entire year.

The rise in demand for higher alcohols was caused not only by normal increase in business, but also because considerable quantities were shipped under the Lease-Lend bill, as well as a result of the fact that the chlorine shortage curtailed production of the synthetic amyl alcohol producer. The result of this curtailment was that more normal butyl was used to obtain the correct solvent for lacquer formulation. Also, certain of the normal butyl derivatives were used in powder manufacture which placed an added demand on restricted production.

Normal butyl acetate, due to the shortage of acetic acid was more in demand than the alcohol. Acetic acid and its production facilities were important in the military program and this resulted in most of the consumers having their requirements cut considerably during the year. In fact, the supply and demand was so far out of line during the latter half of the year that the Price Administrator was forced to raise the level at which these products could be sold by 50 percent over the ceiling set in September and at a price which was practically 75 percent over the closing price in 1940.

This demand for normal butyl, combined with the shortage of ethyl acetate as a result of the curtailment of both ethyl alcohol and acetic acid, brought a demand for normal butyl acetate and many customers who formerly felt this solvent could not be used are now using this product in substantial quantities. The manufacture of alcohol from grain reintroduces fusel oil amyl acetate which has not appeared in the market for several years.

METHANOL

The industrial methanol market which had been strong during the past two years showed further strength during 1941 due to the heavy demand for formaldehyde resins. The synthetic production operating to capacity, showed an increase of approximately 10,000,000 gallons over the 1940 production which is an increase of 25 percent.

During the latter half of the year when the aluminum and copper shortage developed, many industries were forced to replace metals with molded resins. The demand for molded resins which increased so greatly was reflected in a demand for formaldehyde which, of course, meant methanol and resulted in the OPM issuing an order setting into three classes for civilian uses in which resins could be used. It also was the result of the issuance of M-31 of August 28, 1941 which put methanol on a priority basis. In the earlier part of the year substantial quantities of methanol were shipped to the Far East, but this practice was discontinued when the General Preference Order was issued.

Demand for wood distillation methyl as a denaturant increased as a result of the ethyl alcohol expansion so that the usual quantity sold as anti-freeze was not available during the past year. In fact, the demand was so great that customers started to bid for the material with the result that it was necessary for the Price Administrator to issue a seiling order which restricted the price at which methanol could be sold. Due to the shortage of labor and existing facilities, the quantity of methanol cannot be substantially increased. However, there are two synthetic methanol plants expected to be brought in before the end of 1942 which will increase the existing capacity by almost 40 percent. However, the potential military demands for methanol, in additioin to the increasing demands for formaldehyde resins, from present indications will create such a demand on methanol that the OPM was forced to issue an order prohibiting the use of methanol as anti-freeze.

METHYL ETHYL KETONE

Sales of methyl ethyl ketone continued to increase during 1941 due to the demand for this material in defense industries and because many customers who had standardized for years on ethyl acetate found that they could use methyl ethyl ketone to advantage and adopted this solvent as a low boiler.

Prices on methyl ethyl ketone increased, but only about in proportion to the rising labor and raw material costs. One of the producers increased production facilities somewhat, but indications are that this solvent will be under heavy enough demand for the coming year to keep stocks from accumulating.

It is difficult to predict the outlook for alcohols and solvents under conditions so confused. Obviously, as ethyl alcohol, isopropyl alcohol, methanol, acetone, methyl ethyl ketone, as well as the higher alcohols, are vital in defense industries, the emergency demands on these solvents are such that there will not be sufficient quantities of any of these alcohols produced to take care of both the military and civilian demands. Hence, the priority system operated the latter part of last year and, undoubtedly before 1942 is past, virtually all of these products will be under allocation.

The obvious solution, of course, would be to increase all existing facilities, where as last year rising construction costs and existing price levels did not warrant increasing facilities, the present shortage of construction materials, due to diversion to more necessary uses, prohibits increasing any plant unless military demand for the finished product is so urgent that it justifies diverting raw materials from military equipment to industrial plants.

Synthetic Organic Chemicals

For the synthetic organic chemical industry, the year 1941 was precedent-breaking in almost all respects. Production reached an all-time peak in most items. Even though expansions in productive capacity were large, the demands from lend-lease, defense, and finally the war created shortages and hastened government regulations of many important commodities.

During the first half of the year, the organic chemical industry operated at near-capacity and was able to supply the market. Soon, however, shortages began to develop and government regulations in the form of priorities, allocations and price controls became necessary in certain lines. The most serious shortages were in formaldehyde, phenol, methanol, ethanol, ethylene glycol, phthalic acid and phthalates, aniline oil and chlorinated hydrocarbons, although other shortages were evident.

AVIATION GASOLINE

Tremendous demands, especially during the latter part of the year, were made for 100-octane aviation fuel, which itself contains about 50 percent synthetic organic materials, principally isooctane, isopentane and neohexane. Some 20 plants are now producing this fuel and total production for 1941 is estimated at 18,650,000 bbl. as compared to 14,000,000 bbl. for 1940. The domestic demand amounted to 13,500,000 bbl. compared with 6,570,000 bbl. in 1940. Exports in 1941 were 4,800,000 bbl.

Late in the year, the R.F.C. made plans to loan $50,000,000 to build 50 new refineries and byproduct plants in order to triple the nation's capacity of 100-octane gasoline. This program was given a boost in December when five oil companies owning patents on processes of manufacturing aviation gasoline agreed to reduce their royalties by 50 percent or to 21 cents per bbl. This rate will be effective until July 1, 1943, at which time prices will be lowered to 15 cents per bbl. At present the alkylation process is the principal method for the manufacture of blending materials for 100-octane gasoline.

Tetraethyl lead for use in gasoline became scarce because of the heavy demands for high-octane fuels and also because of the serious shortage in chlorine. One estimate placed production of tetraethyl lead during the latter part of the year at the rate of about 150,000,000 lb. annually, of which at least 50 percent was going into defense channels prior to United States declaration of war. Of considerable importance is the recent announcement by the Ethyl Gasoline Corp. of a new process for making ethyl chloride for tetraethyl lead from hydrochloric acid.

TOLUOL

One estimate has valued the synthetic organic chemicals now being produced from petroleum raw materials at near $100,000,000 annually. This figure will probably be increased two or three times within the next few years.

Toluol was first produced in this country from petroleum on a large scale in 1940. During 1941, recovery of toluol from byproduct coke operations reached a peak, but such strides have been made in its recovery from petroleum that of the present toluol capacity of 100,000,000 gal. annually from plants operating and under construction, some 70 percent will be derived from petroleum. There is now talk of increasing this capacity to 200,000,000 gal. annually.

Principal methods for production of toluol from petroleum are the extractive and the catalytic processes. The largest petroleum plant manufacturing toluol employs the catalytic method and has a capacity of nearly 30,000,000 gal. annually. A number of smaller catalytic plants with a combined output of about 30,000,000 gal. were under construction during the latter part of the year. Several plants using the extractive process have a total production of about 10,000,000 gal. Exports of toluol for the first nine months of 1941 exceeded 19,300,000 lb.

In October, the Baytown Ordnance Works began production of toluol by the catalytic process in a plant operated by the Humble Oil & Refining Co. Total cost of the plant was $11,857,000.

Shell Oil Co. announced in May that it would build a second distillation-solvent extraction plant in the Southwest to duplicate the first petroleum toluol plant in this country which went into operation at that refinery in December 1940. This second plant, completed in October, brought the Shell Oil Co.'s total toluol capacity to 4,000,000 gal. per year. Later in the year, the company announced the construction of a third plant, located in the Middlewest and to be completed early in 1942, which will double the present capacity.

Pan American Refining Corp. announced successful operation of a hydroforming refining unit from which approximately 5,000,000 gal. of toluol could be produced annually. During the latter part of the year, Socony-Vacuum Oil Co. announced plans to construct in the Middlewest a toluol plant estimated to cost in the neighborhood of $1,000,000.

PHENOL

Phenol was one of the first organic materials in which a serious shortage developed during 1941. Synthetic production of Barrett, Dow, Durez and Monsanto is estimated to be in the neighborhood of 105,000,000 lb. out of a total production near 130,000,000 lb. Production of both natural and synthetic phenol in 1940 was 96,000,000 lb. Plastics have consumed perhaps 60 percent of the total and this propor-

Table I—U. S. Production of Certain Non-Coal-Tar Synthetic Organic Chemicals[1]

	1939	1940
Acetaldehyde	....	201,484,831
Acetic acid (100%)	119,652,650	186,364,384
Acetone	....	201,506,334
Amines, total	1,487,643	1,969,441
Butyl acetate, total	77,734,214	86,721,057
Butyl alcohol, total	127,010,364	164,568,813
Butyl alcohol, normal	72,736,886	100,412,850
Carbon tetrachloride	90,535,580	100,811,330
Chloroform	2,933,322	3,078,521
Diacetone alcohol	3,220,729	4,671,512
Ethyl acetate (85%)	67,897,408	75,368,803
Formaldehyde (40%)	134,478,827	180,884,573
Isopropyl alcohol	179,062,266	219,925,900
Lactic acid (tech.)	1,530,456	1,869,365
Methyl chloride (100%)	3,021,078	3,041,661
Oxalic acid	10,416,269	12,921,227

[1] From U. S. Tariff Comm. All figures are in pounds.

tion has been rapidly increasing. DuPont's production of phenol has been largely channeled into adipic acid for nylon synthesis.

Plans were made during the year to increase phenol production, but most of the additional output will not be ready until 1942. Part of the acute shortage during the latter part of the year was caused by Russian requests for large quantities for manufacture of picric acid and other military commodities.

Late in the year both Solvay Process Co. and General Electric Co. announced plans for the construction of phenol plants. The Solvay unit has been estimated to cost some $500,000 while the General Electric synthetic plant will cost $1,000,000 and is expected to be in operation by September 1942. This plant is intended to supply about 75 percent of the company's present requirements of phenol for plastics. In addition, duPont has developed a process for the manufacture of adipic acid for use in nylon which will not require phenol as a raw material. The new process is said to be scheduled to begin operations during the spring of 1942.

DYES AND INTERMEDIATES

Production of dyestuffs reached a new record in 1941 with an estimated increase of about 38 percent over 1940. Preliminary figures have placed the value of these dyestuffs at approximately 45 percent more than the previous record for 1940. Demands for military purposes brought forth large orders, but it was only during the latter part of the year that manufacturers found difficulty in supplying both civilian and defense needs.

Aniline oil developed into one of the most critical of the intermediates, since it was in heavy demand not only for the manufacture of some 250 important dyes but also because as a raw material for dimethylaniline, used in explosives, as well as for a large number of rubber accelerators and anti-oxidants. Aniline used for rubber chemicals alone has been estimated at between 12,000,000-17,000,000 lb. per year or 20-30 percent of the total aniline production for 1940. Probably some 80-85 percent of domestic aniline production was being diverted to defense uses prior to United States declaration of war.

During 1941 the Tennessee Eastman Corp. entered the acetate dye manufacturing field and Dow Chemical Co. spent over $1,000,000 for increased phenol and dyestuffs capacity. In Canada, the Ciba Co. recently announced that it would spend some $200,000 on a plant for the manufacture of dyestuffs and pharmaceuticals.

Large quantities of picric acid were needed for military purposes, but expansions provided for the additional explosives requirements. This permitted some diversion of the acid to picramic acid for use in processing dyestuffs. During 1941 the War Department constructed a large plant, costing $16,750,000, in the Midwest to produce picric acid for explosives. Phenol, sulphuric acid and nitric acid are the raw materials for picrate explosives.

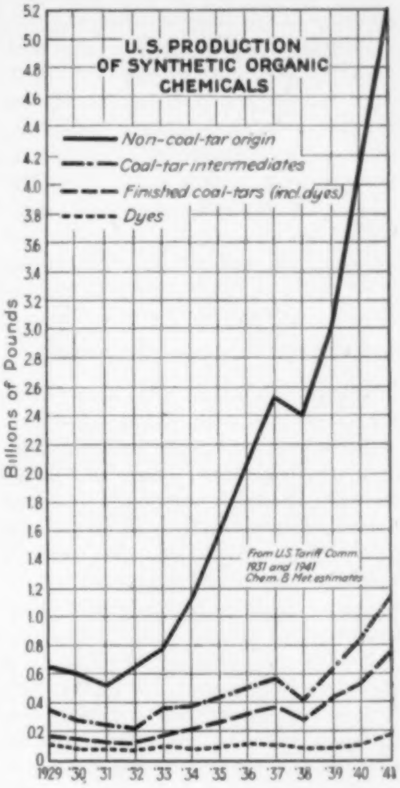
SYNTHETIC RUBBER CHEMICALS

At the end of the year, about 75 percent of the synthetic rubber capacity was utilizing petroleum-base raw materials. In addition to butadiene, acrylonitrile and styrene which are not normally made from petroleum, can also be produced in refineries if necessary. The recent government decision to produce 400,000 tons of synthetic rubber by the middle of 1943 will require a tremendous increase in the amount of butadiene for processing. It has been estimated that the butadiene necessary for this tonnage can be produced as a byproduct in the 100-octane gasoline plants now operating or under construction.

Of the proposed synthetic rubber production of 400,000 tons, some 70 percent will probably be Buna types which require about 17 percent dibutyl phthalate as plasticizers. Obviously the synthetic rubber program will also require tremendous quantities of butyl alcohol and phthalic acid as well as accelerators and anti-oxidants.

In 1939 the Dow Chemical Co. was the only producer of butadiene, but in 1940 Shell Oil Co., Phillips Petroleum Co., Standard Oil Co. and Carbide and Carbon Chemicals Corp. all constructed plants for the manufacture of this material. During 1941, the Carbide and Carbon Chemicals Corp. authorized some $5,000,000 for construction of an additional butadiene plant in the South, and in March this company shipped its first tank car of butadiene from its eastern plant.

Standard Oil Co. of La. started a $7,500,000 butadiene plant with a capacity of 15,000 tons annually. Shell Oil Co. and the Shell Chemical Co. announced a second plant in the Southwest to cost $3,000,000. The first Shell plant, having an annual capacity in excess of 5,000 tons, began operations in the summer of



1941. The Phillips Petroleum Co. completed its plant and began operations, while the Standard Oil Co. of La. started construction of a $12,000,000-$15,000,000 synthetic rubber and chemical project at one of its southern refineries. Monsanto Chemical Co. recently announced that it would build a plant for the manufacture of chemicals used in production of synthetic rubber at an approximate cost of $2,200,000.

During the year, Thiokol Corp. and Dow Chemical Co. opened a new plant for the production of Thiokol, utilizing ethylene dichloride, having a capacity of more than 150,000 lb. per month. With other Thiokol units operating and planned, this will boost output to 6,000,000 lb. annually as compared with 4,000 lb. in 1930, the first year this material was made. In addition, officials have already begun to plan for another unit which would increase total production by 50 percent.

E. I. duPont de Nemours & Co.

Table III—Acetic Acid and Derivatives[1]
Chem. & Met. Estimates

	1938	1939	1940	1941
Production .	157	227	260	295
Imports	6	2	2	4[2]
Exports	3	6	10	6[2]
Consumption.	160	223	252	293

[1] Millions of pounds, basis 100% acetic acid.
[2] Based upon 9 months' actual.

announced in June a new neoprene synthetic rubber plant in the Midwest to have a capacity of 10,000 long tons a year. Recent additions to this concern's eastern plant will increase production of neoprene at that location from 6,000 to 9,000 tons before the end of the year. Acetylene for the new duPont plant will be supplied by a new $2,500,000 calcium carbide plant now being constructed by the Air Reduction Co.

ACETIC ACID AND ACETATES

While production of acetic acid was increased, the output was not sufficient and supplies of ethyl, amyl and butyl acetates were not large enough to take care of domestic needs. Steps were taken by the government to curtail the use of acetic acid in the manufacture of cellulose acetate rayon for civilian consumption.

Part of the scarcity of acetic acid was caused by a shortage in raw materials. Some calcium carbide was diverted to other channels and a shortage of electric power at Niagara Falls curtailed the acteylene supply even further. In December, Judge B. Perkins Associates announced construction of a plant for hardwood distillation and acetic acid and wood alcohol recovery at an estimated cost of $2,500,000. The Union Charcoal Co. also built a small acetic acid plant in the East.

Production of acetic acid and derivatives (basis 100 percent acid) for 1941 is estimated at 295,000,000 lb., with approximately 6,000,000 lb. exported and 4,000,000 lb. imported. Consumption in cellulose acetate has been placed at 140,000,000 lb. as compared to 96,000,000 lb. for 1940.

PHTHALIC ACID AND ANHYDRIDE

Although production of phthalic acid and anhydride increased from 58,000,000 lb. in 1940 to an estimated 80,000,000 lb. in 1941, this increase still did not take care of all demands. Probably 75 percent of the year's phthalic anhydride production went into resins and plasticizers. Large amounts of dibutyl phthalate were required in the manufacture of smokeless powder and synthetic rubbers will soon require larger amounts, as the content of dibutyl phthalate in Buna S rubber may run as high at 17 percent. Production of dibutyl phthalate in 1940 was 8,800,000 lb.

Near the end of the year the 1942 demand for phthalic anhydride was estimated at 100,000,000 lb., but this figure will now be boosted considerably because of recently increased synthetic rubber and explosives demands.

Plans were formulated to expand the output of phthalic anhydride and by the end of the year additional facilities were operating. The Barrett Co. expanded its plant and it was rumored that capacity would be doubled. Reichhold Chemicals, Inc. spent $1,000,000 for expansion of phthalic anhydride and synthetic resin production. Earlier in the year, National Aniline & Chemical Co. made plans for considerable enlargement of its plant for the production of phthalic and maleic anhydrides.

A shortage of methyl ethyl ketone prevailed throughout most of the year although monthly production was stepped up from 500,000 gal. to approximately 700,000 gal.

O.P.M. placed under rigid priority control all stocks of chlorinated solvents and refrigerants, including Freon, carbon tetrachloride, trichloroethylene, perchloroethylene and ethylene dichloride. This action was due to the acute chlorine shortage during the latter part of the year. Construction of a new plant for the maufacture of chlorinated hydrocarbon solvents for defense uses was announced by duPont. The plant, expected to be in production by the summer of 1942, will supplement the plant already in production.

With three new producers entering the field within the last three years, production capacity for ethylene glycol has been nearly doubled. However, production of this commodity for use as an automobile anti-freeze was curbed because of the needs of the aviation industry. Production of ethylene glycol will probably soon go entirely to military needs as the number of liquid-cooled bombers increases rapidly in the near future.

Table IV—U. S. Exports of Certain Synthetic Organic Chemicals [1]

	1941 (9 mos.)[2]
Toluene	19,375
Phenol	2,086
Acetic acid	4,955
Acetic anhydride	138
Ethylene glycol	3,154
Butyl alcohol	3,873
Acetone	18,509
Butyl acetate	4,319
Formaldehyde	1,849
Amyl acetate	433
Carbon tetrachloride	2,032
Ethyl acetate	876
Ethyl ether	525
Methyl ethyl ketone	1,777
Methanol (gal.)	377

[1] From U. S. Dept. of Commerce.
[2] As thousands of pounds.

Because of the heavy demand for plastics and also the tight situation in respect to methanol, the formaldehyde situation became critical relatively early in the year. Production for 1941 has been estimated at 277,000,000 lb. (basis 40 percent) as compared to 180,000,000 lb. for 1940. Some 48 percent of domestic methanol production was converted into formaldehyde as compared to 30 percent in 1940. Although some formaldehyde is now being manufactured by the oxidation of hydrocarbons from natural gas, this source has not yet become important in the market. It has been estimated that close to 75 percent of the formaldehyde produced in this country goes into synthetic resins for plastics, less than one percent to textiles and dyestuffs each, and a little more than one percent for embalming fluid.

BUTYL ALCOHOL

Production of normal butyl alcohol for 1941 has been estimated at 155,000,000 lb., of which some 70 percent was produced by fermentation methods and 30 percent by synthetic processes. This commodity was scarce even though 1941 production was 55 percent greater than that for 1940. A large percentage of the production went into butyl acetate.

Domestic requirements of camphor are now being supplied largely by two producers, E. I. duPont de Nemours and Newport Industries, Inc. Imports of synthetic camphor in the first nine months of 1941 reached a new low of 5 lb., while imports of the Japanese refined and crude grades totalled only 652,000 lb. The duPont plant has an estimated capacity of 4,500,000 lb per year.

Situation in respect to ammonium thiocyanate, formerly imported from

(*Please turn to page* 108)

Table II—U. S. Production of Coal-Tar Synthetic Organic Chemicals [1]

	1937	1938	1939	1940	1941[2]
Intermediates	575,893	401,943	607,175	805,807	1,125,000
Dyes	122,245	81,759	120,191	127,834	176,000
Color lakes and toners	18,041	14,407	18,154	19,213	25,000
Medicinals	14,800	11,097	15,188	18,214	23,000
Flavors and perfumes	4,356	3,837	5,349	5,485	7,000
Rubber chemicals	29,202	18,771	29,966	37,139	44,000
Miscellaneous	42,395	39,593	69,681	92,023	129,000

[1] As thousands of pounds. Data for 1937-40 from U. S. Tariff Comm.
[2] Approximated.

Rayon and Synthetic Fibers

As yet, rayon has hardly begun to play its eventual part in the war effort. The new record established by its 1941 performance was almost entirely in the meeting of civilian demand. Not considering the non-cellulose-base fibers, filament yarns were up about 16 percent, and staple, over 50 percent. Total consumption of both forms increased 20 percent over 1940.

In the 21 years shown on the accompanying chart, there have been only three when rayon production has not hit a higher level than any previous year. It is not surprising, then, that 1941 was no exception. This high level was achieved with only a minimum of assistance from war production. True, military items are being made in considerable quantity from rayon and nylon, but the percentage is still small compared with civilian consumption. Rayon's big contribution to the military effort is still to come. In the meantime, with the cessation of all silk receipts and the freezing for military use of all raw silk in the country, rayon and other fibers have at last been called upon to take over almost the entire load formerly carried by silk—an annual load which in past years has ranged as high as 81,000,000 lb. Should a wool shortage develop more seriously than is now anticipated, rayon will be forced to fill in there, also, not only for civilian but for military purposes as well.

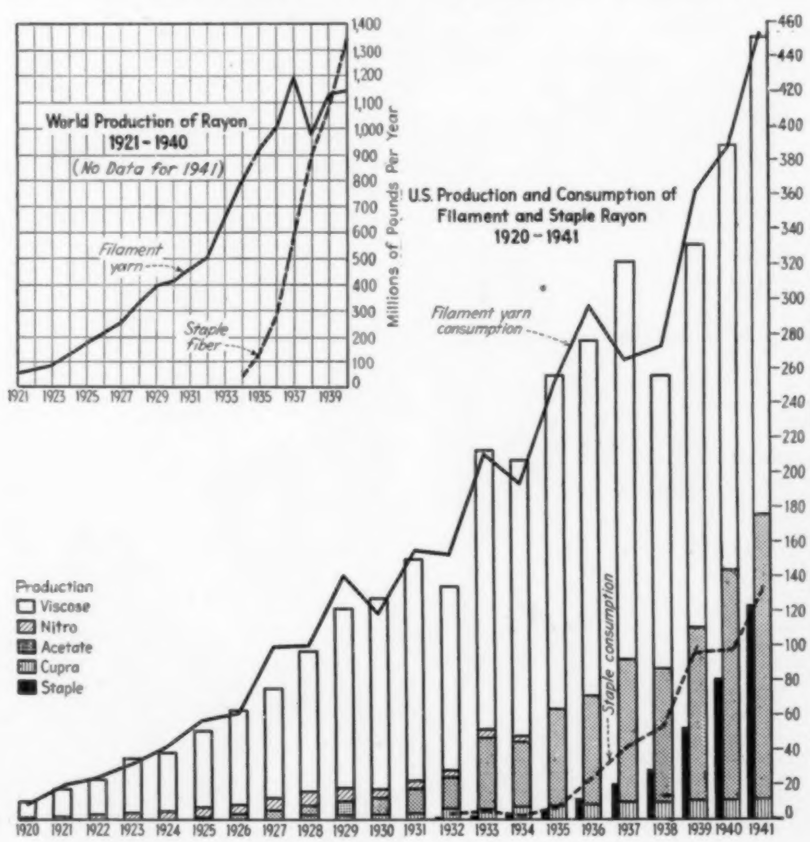
As in the past, the annual statistics for the industry have been assembled and reported by the *Rayon Organon* and it is these figures which we quote. Unfortunately, 1941 world data are not to be had. For the United States, however, full information is still available. According to the *Organon,* total filament yarn production for 1941 reached the peak of 451,204,000 lb., not including nylon and the protein fibers. This was an increase of nearly 16 percent over 1940. Filament yarn consumption exceeded production by slightly over a million pounds, another 16 percent gain, while staple fiber production increased by over 50 percent, to a total of 122,026,000 lb., compared with consumption of 133,626,000 lb. Where staple imports amounted to 18 percent of consumption in 1940, the war so reduced this source in 1941 that imports were less than 9 percent in 1941, and had dried up almost completely by the end of the year.

For the entire year the industry operated practically at capacity. New facilities went into operation and, whereas the *Organon* estimated the conservative capacity of the filament plants at 395,000,000 lb., and of staple at 110,000,000 lb. at the end of 1940, it set the comparable figures at 450,000,000 lb. and 150,000,000 lb. respectively as of the end of 1941. Although additional staple capacity has not yet been announced for the next 18-months' period, a conservative capacity of 475,000,000 lb. of filament yarn capacity is expected for March 1943.

PRODUCTION BREAKDOWN

The filament yarn production for 1941 was broken down into 287,459,000 lb. of viscose and cuprammonium yarns (of which we believe that about 13,000,000 lb. was cupra), and 163,745,000 lb. of acetate. Thus, acetate continued its long-time trend toward a greater percentage of the total, accounting in the current year for 36.3 percent of the filament yarn, com-

(*Please turn to page* 108)



Rayon Production and Imports
1921-1941

	Thousands of Pounds		
	U. S.* Production	U. S.† Import Balance	World* Production
1921	18,000	3,276	65,000
1922	26,000	2,116	80,000
1923	35,000	3,029	97,000
1924	38,750	1,954	141,000
1925	52,200	5,293	185,000
1926	62,575	8,945	219,000
1927	75,050	14,633	267,000
1928	97,700	11,948	345,000
1929	121,369†	14,832	404,000
1930	127,333†	5,995	417,000
1931	150,879†	1,490	470,000
1932	134,670†	−456	509,000
1933	213,498†	−176	660,000
1934	208,321†	−2,432	799,589
1935	257,557†	−2,193	932,780
1936	277,626†	−1,558	1,022,000†
1937	321,681†	−525	1,199,000†
1938	257,916†	−1,195	990,000†
1939	331,200†	−1,703	1,145,000†
1940	390,072†	−1,453	1,143,960†
1941	451,204†	−3,193	‡

* From *Textile World* except as noted: does not include staple.

† From *Rayon Organon.* Does not include staple which is estimated at 350,000 lb. in 1930; 880,000 lb. in 1931; 1,100,000 lb. in 1932; 2,100,000 lb. in 1933; 2,200,000 lb. in 1934; 4,600,000 lb. in 1935; 12,300,000 lb. in 1936; 20,244,000 in 1937; 29,861,000 lb. in 1938; 51,300,000 lb. in 1939; 81,098,000 lb. in 1940; and 122,026,000 lb. in 1941. World staple estimated at 6,100,000 lb. in 1930; 52,700,000 in 1934; 139,900,000 lb. in 1935; 299,000,000 lb. in 1936; 619,000,000 lb. in 1937; 958,000,000 lb. in 1938; 1,025,000,000 lb. in 1939; 1,236,850,000 lb. in 1940‡. Import balance does not include staple: minus sign indicates net exports; staple imports 12,721,000 lb. in 1936; 20,614,000 lb. in 1937; 23,197,000 lb in 1938; 47,403,000 lb. in 1939; 17,736,000 lb. in 1940; and 11,600,000 lb. (est.) in 1941.

‡ No data for 1941.

Fats and Oils

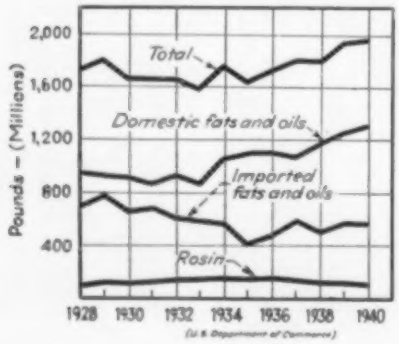
Both linseed and soybean oil production established new records in 1941. Domestic consumption of all fats and oils was also at a new high. War-blocked sea lanes and shortage of bottoms needed for imports from overseas areas threaten a tight situation and shortages will be felt in 1942.

DOMESTIC consumption of fats and oils in 1941 set a new record. Official estimates have placed the figure somewhere near 11 billion pounds. This represents a 13 percent increase over 1940, the previous record year.

Fats and oils demand in 1942 will unquestionably exceed the supply. War in the Far East has cut off more than half the normal supply of fats and oils imported into the United States. This means that 10 or 12 percent of our usual total supply will not be available for 1942. Unfortunately, the demand for all fats and oils will probably be 10 or 15 percent greater this year than in the record year just completed. Stimulation of all possible sources of domestic oils and fats is being planned. Shortage of specific oils, however, will necessitate makeshift chemical engineering in many branches of process industry.

Soap—Theoretically, the soap industry could do very well without its 400 million pounds of imported lauric acid oils. It has been demonstrated that soaps made only from oleic and palmitic acids are equal in detergency to the conventional soaps which contain lauric and stearic acids in addition. Economically, however, separation of the large quantities of unwanted stearic acid from the oleic and palmitic acids raises a matter of cost which can not be disregarded. Practical consideration of the problem also reveals another insurmountable barrier: Equipment to produce this wanted fraction of the domestic fats and oils is not available and could not be obtained in a reasonable time under present conditions.

Fats and oils, rosin used in soap



The stage is now set for production of a synthetic coconut oil or lauric acid as an alternative means of relief for the soap industry. The immediately needed quantity of these materials is even farther from sight: Technology, economics, and available equipment are all negative. The answer is that soap quality will be noticeably poorer by the end of 1942, with little improvement in sight before the end of the war.

Synthetic or fermentation glycerine production is also called for, but spontaneous production was doomed by the glycerine price ceiling established last October. Technically it has been demonstrated that glycerine can be made outside the soap kettle. However, with the present 18c. ceiling on glycerine there is little inducement for either the Shell process or a fermentation process to be initiated. If the glycerine demand is pressing enough, an RFC subsidy may be arranged to bring out this additional production wherever possible.

Drying Oils—Probably the most important drying oil advance of 1941 was in the field of conjugating semi-drying oils to improve their drying properties. A number of processes are being developed and some of the products are already on the market. Further improvement is expected in many of these products in the next year.

Progress of the Armour process fractionation of semi-drying oils has also been encouraging during the past year, but this process requires considerable amounts of scarce stainless steel equipment. Completion in late 1941 of the first large scale unit (30 million lb. per year capacity) will still provide only a little more than a drop in the bucket as far as supplying the needed quick-drying oils.

Production of Domestic Fats and Oils

	—Millions of Pounds—		
	1939	1940	1941
Butter[3]	1,814	1,816[1]	1,900[2]
Corn oil	151	158	203
Cottonseed oil	1,390	1,274	1,391
Fish oils	245	167	187
Greases & inedible tallow[4]	1,134	1,384	1,512
Lard	1,998	2,297[1]	2,200[2]
Linseed oil	266	385	525
Neats-foot oil	5	4	4
Oleo oil	76	69	92
Olive oil	7	4	10
Peanut oil	73	84	150
Soybean oil	458	533	586
Stearin (edible)	38	36	48
Tallow (edible)	94	79	91
Whale oil[5]	27	20	[6].....
Total	7,776	8,310[1]	8,900[2]

[1]Preliminary. [2]Estimated. [3]100 percent butterfat. [4]Computed from reported factory consumption, stocks and foreign trade. [5]May include other marine animal oils. [6]Less than 500,000 lb.

Selective solvent extraction processes continue in pilot plant stage. Both Pittsburgh Plate Glass Co. and the U. S. Soybean Laboratory are working on this problem. Economically the processes have yet to justify themselves on a commercial production scale. The added incentive of the present emergency will be the opportunity to make or break them.

Tung oil substitutes are rumored frequently, but materialize less often. Among those on which reliable information is available is Pure Oil Co.'s "petropol," which has had enthusiastic reception. It is a petroleum by-product, made by extracting and polymerizing an intermediate olefin. The iodine number ranges from 175 to 225 and the price last March was about 4c. per lb. In addition to the paint and varnish uses for this material, it has found an outlet as plasticizer in linoleum, wallboard, brake lining and many other materials.

Also noted in 1941 was the increased use of addition products to improve the bodying properties of drying oils.

Molecular distillation improvement of semi-drying oils has been proposed as a possible source of the scarce materials. However, economic use of this process on anything but an emergency basis is questionable. No

Imports of Foreign Fats and Oils[1]

	—Millions of Pounds—		
	1939	1940[2]	1941[3]
Babassu oil	72	63	36
Castor oil	73	107	131
Coconut oil	608	759	573
Cod-liver oil	50	16	9
Corn oil	14	.....[4]	1
Cottonseed oil[5]	29	12	4
Linseed oil	305	225	216
Oiticica oil	19	16	30
Olive oil (edible)	63	50	8
Olive oil (inedible)	39	30	5
Palm oil	289	225	223
Palm kernel oil	6	13	6
Peanut oil	4	3	2
Perilla oil	51	11	5
Rape oil	12	15	16
Sesame oil	9	7	3
Soybean oil	4	5	1
Teaseed oil	5	4	1
Tung oil	79	97	26
Whale oil	20	22	2
Animal fats and oils[6]	10	7	23
Fish oils[6]	17	4	11
Vegetable fats and oils[6]	37	16	32
Totals	1,815	1,707	1,364

[1]Includes oil equivalent of seeds, nuts, etc. [2]Preliminary. [3]Preliminary; for 9 months only. [4]Less than 500,000 lb. [5]Almost all refined. [6]Not otherwise specified.

plant facilities for production by this method are now in operation, so far as is known.

Food Fats—Activity in the field of soybean and peanut flours was probably the outstanding technical development of 1941 in the food fat field. The Surplus Marketing Administration of the U. S. Department of Agriculture was primarily responsible for this work in an effort to produce a concentrated, relatively non-perishable fat-and-protein food for overseas consumers, Army, Navy and Lend-Lease. New technics and equipment were being found particularly necessary for the production of a satisfactory peanut flour.

Use of frozen lard as a refrigerant in the transatlantic shipment of meat to Britain was developed in 1941, showing that perishable foods may be safely shipped in boats without refrigerated cargo space. The fact that the refrigerant itself is a food when it reaches its destination will greatly stimulate this particular outlet for lard. With an extra 50 million or more people to feed via Lend-Lease, this factor may not be inconsiderable.

Special Uses—Although imported palm oil has long been thought essential in the tin plate industry, the supply now available in this country is more than adequate for the amount of tin that is in sight. Further supplies may be imported from Nigeria, if shipping space is available. Moreover, hydrogenated cottonseed or peanut oil and synthetics based on these oils are said to be readily available as substitutes for palm oil in tin plating when and if necessary. Development work with these materials has been carried on at the Southern Regional Research Laboratory of the U. S. Department of Agriculture.

Olive oil, though long preferred as a lubricant in wool manufacture, may find that it has been replaced when supplies from the Mediterranean area return to normal. A two-to-one mixture of refined mineral oils and coconut oil is said to have the desirable attributes of olive oil for this use and also to last longer and cost less. A substitute for coconut oil in this textile lubricant is now in order.

Statistics — Domestic harvest of flaxseed in 1941 was one of the largest ever recorded. Large surplus stocks in the Argentine and an exportable surplus of flaxseed in Canada make linseed oil one of the few bright spots in the entire fats and oils picture. Although soybeans harvested and peanut oil production set new records in 1941, demand for all fats and oils kept prices at a high level.

Allocation of the dwindling tung oil stocks to most urgent war needs is an example of the type of control that may be necessary on many other fats and oils before the war ends. Diversion of tung oil for those few uses which were still possible with the limited supply of 1941 have further increased the demands for a substitute of linseed oil. Many paint formulas of the 1920's are being used again.

Supplies of oiticica oil imported during 1941 were large. However, preliminary estimates indicate that the 1942 crop may be reduced considerably as the result of unfavorable weather conditions in Brazil.

Import of castor beans and production of dehydrated castor oil also set new records in 1941. Domestic production of castor beans will be significant for the first time in the coming season. The 1941 crop was reserved entirely for seed purposes.

Importation of tung and perilla oils cannot be expected for the next year or two, at best. Stocks of these Oriental oils in this country are sufficient to last only a few months. When these are exhausted we shall be dependent entirely on Western Hemisphere oils.

Production of South American castor beans, babassu nuts, and oiticica nuts will be stimulated to the greatest extent possible. Since these materials are not cultivated and harvested extensively, production is dependent on local conditions to a great extent. However, as long as Western Hemisphere shipping is available for these materials they will be imported and there will be a ready market for every pound.

Argentine flaxseed should flow to the United States in increased quantities now that the tariff has been halved by the recent trade agreement with that country. Although 32½c. per bu. is the figure for the duration of the emergency, provision has been

Our Stockpiles of "Strategic" Fats and Oils

1941 Statistics
(Millions of Pounds)

Quantities of fats and oils reported by Bureau of Census as factory and warehouse stocks on indicated dates. Oil content of raw materials is included in the calculations. Only those oils are included which are imported in significant quantities or which are relatively irreplaceable by domestic oils. The stocks of castor oil and linseed oil on Dec. 31, 1941 (latest available data) were 75 percent of an average year's supply; all other stocks were less than 40 percent of the imports for an average year. (Average domestic production of linseed oil for the same five years was 212,000,000 lb.; imports were 320,000,000 lb.)

	Average Imports (1936–40)	Stocks on Hand Dec. 31 1940	Mar. 31 1941	Jun. 30 1941	Sept. 30 1941	Dec. 31 1941
Babassu	48	9	14	8	5	12
Coconut	656	301	270	227	249	237
Palm kernel	50	3	5	6	4	2
	754	313	289	241	258	251
Castor	60	31	43	46	51	48
Linseed	320	286	271	216	397	438
Oiticica	13*	......	......	......	......	......
Perilla	52	7	6	9	6	5
Tung	119	57	44	37	33	33
	573	381	364	308	487	524

* 1938–1940 average

Five-Year Average Statistics, (1936-40)
(Millions of Pounds)

Average quantities of the "strategic" oils used in the last five years for which data are available, and the average stocks on hand by quarters and for the year. Note that the total stock of coconut oil on Dec. 31, 1941 would last only nine months if used only by the soap industry at the 1936-40 average rate. Since food manufacturers have been using coconut oil also, the stocks will probably be exhausted by mid-1942. If the largest recorded imports of South American babassu oil and West African palm kernel oil were again imported, approximately half the needs of the soap makers alone could be met.

	Used in Soap Industry	Stocks on Hand Dec. 31	Mar. 31	Jun. 30	Sept. 30	Average
Babassu	22	5	8	9	5	7
Coconut	337	225	214	229	207	219
Palm kernel	34	13	12	14	16	14
	393	243	234	252	228	240
	Used in "Drying" Industry					
Castor	11	25	27	28	23	26
Linseed	329*	225	226	180	296	232
Oiticica	....	......	......	......	......	......
Perilla	41	16	15	17	20	17
Tung	90	46	44	47	53	48
	471	312	312	272	392	323

* Factory consumption; 200,000,000 lb. used annually outside factories

made for a 50c. tariff following the war. The supply, if it is more than adequate for the paint industry, will be readily absorbed by food, soap and other uses as demand for Lend-Lease shipments of fats and oils is insatiable.

Government Control—Government control of fats and oils was well established by the end of 1941. It began with export license control, effective April 15. Glycerine exports had already been under this control for some time.

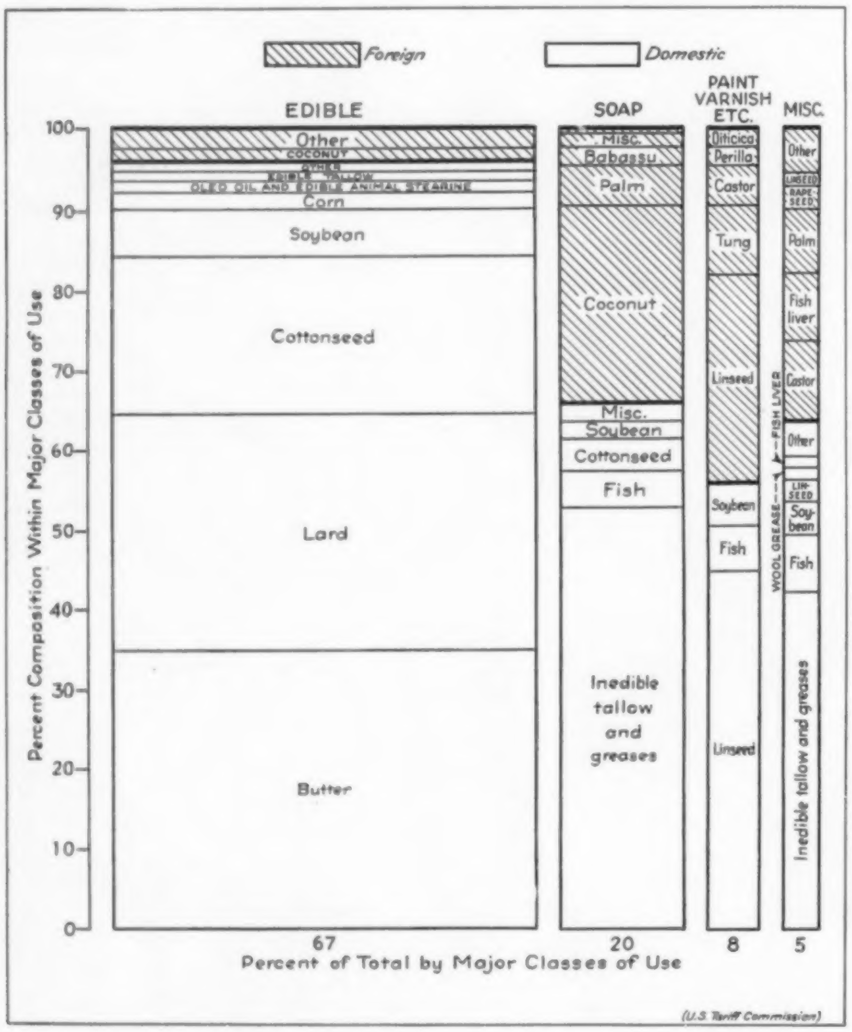
The next step in control was a warning by the Office of Price Administration on June 27 that a price ceiling might be established. This warning came after a six-month period of rising prices during which fats and oils prices rose about 50 percent. The rate of price rise then slowed up for the last half of the year, in spite of the fact that a statement made late in August removed threat of a ceiling "unless a run-away market should develop."

After the outbreak of war on December 7, prices immediately jumped. The Office of Price Administration acted within a week and set a temporary price ceiling based on prices of November 26. On December 31, this price ceiling was modified "to conform with the intent of Congress" to require that no agricultural ceiling could be fixed below October 1 market prices. In effect, this order raised the price ceiling at least 11 percent from the original announcement. Special provision was "made for soybean oil and linseed oil and for other fats and oils the prices of which were below their normal relation to the price of cottonseed oil on October 1, 1941." Except for butter, essential oils and mineral oils, the new ceiling covers all raw, crude and refined fats and oils and their byproducts and derivatives, as well as greases. Specifically excluded are sales of fats and oils products in the finished form; sales of refined fats and oils—except olive oils—through wholesale and retail channels; sales directly to the baking, restaurant, hotel and other cooking trades; and sales of lard destined for human consumption without further processing.

Prices of fats and oils thus increased nearly 75 percent during the year 1941. Several factors contributed to this rise: Domestic demand was strengthened as a result of increased industrial activity and increased consumer incomes; lard production was a little lower in 1941 than in the preceding year; shipping costs for imported oils were higher and volume of imports was smaller during the first half of the year; exports of fats and oils increased; inventories were built up in anticipation of higher prices; and Government purchases of lard and butter were made to "support" the market. As a result, fats and oils entered 1942 about 25 percent above the 1927-29 price level.

Further control of the same fats and oils covered by the OPA order was established by the OPM Priorities Division order forbidding any manufacturer or processor from buying more than a 90-day supply. The order, issued on December 29 and effective immediately, also prohibits any delivery of the controlled prod-

Distribution of fats and oils among major uses in the United States — 1940



Production Goals—1942

This production of fats and oils is theoretically possible—if production goals for agricultural commodities are achieved, if harvests and oil yields are normal and if crushing capacity is made available. Actual production will probably be somewhat under these figures.

Product	Millions of Pounds
Corn oil	200
Cottonseed oil	1,400
Lard	2,650
Linseed oil	550
Peanut oil	650
Soybean oil	1,100

Production of Secondary Fats and Oils*

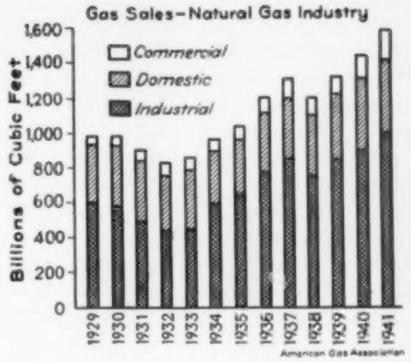
Product	1939	1940	1941
	—Millions of Pounds—		
Shortening	1,404	1,190	1,410
Hydrogenated oils	833	803	917
Stearin, vegetable	96	72	86
Stearin, animal, inedible	15	21	40
Lard oil	22	28	51
Tallow oil	8	9	11
Fatty acids	127	123	160
Fatty acids, distilled	40	42	51
Red oil	49	53	77
Stearic acid	34	41	56
Glycerine, crude (80% basis)	184	197	245
Glycerine, dynamite	66	72	88
Glycerine, chemically pure	87	90	114
Cottonseed foots (50%)	139	123	136
Cottonseed foots, distilled	49	33	36
Other veg. oil foots (50%)	135	89	118
Other veg. oil foots, dist.	1	1	2
Acidulated soap stock	66	49	63
Miscellaneous soap stock	1	2	2

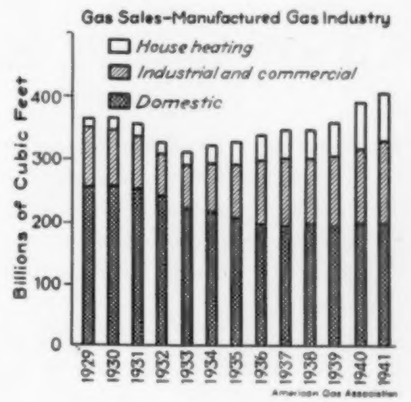
*Products in this table result from refining or processing of all fats and oils, both imported and domestic. They present as complete a statistical picture of the fats and oils process industries as is possible from the figures reported by Census.

ucts in excess of 90 days operating supply.

Price ceilings have also been set for glycerine by an OPA order establishing a maximum of 11¼c. per lb. for crude glycerine (80 percent) and 18c. per lb. for refined glycerine. These were considerably below prices prevailing when the order was announced on October 8, effective November 10.

Outlook—In spite of price and supply controls, serious shortages of one kind of oil or another will be felt within the year ahead. The interchangeability of oils will thus be put to a very practical test. If crop yields are normal in 1942, domestic production of fats and oils may be adequate for the indicated domestic demand. If, by good fortune, bumper crops are obtained or the expected demand does not materialize, a surplus of fats and oils above domestic needs will develop, but this will be more than absorbed by Lend-Lease demands. A surplus of food fats for feeding the war-torn nations would also be of great value when the United States is sitting at a conference table helping to write the Peace. Certainly World need will exceed supply for some time to come.





Gas and Coal Products

Sales, revenue and number of customers during 1941 increased for both manufactured and natural gas industries. Production of byproduct and beehive coke during December established an all-time monthly record and brought 1941 total to a point far exceeding any previous annual production.

Industrial use, to a great extent by chemical process industry, enabled both manufactured gas and natural gas distributors greatly to increase their total send-out in 1941 over the previous year. Most household and some commercial usage was practically at a standstill or declined slightly. Thus, the industrial customer became far more important than formerly for both divisions of the utility gas business.

Despite the lack of increase in household sales as a whole, the number of customers served by the gas industry increased several percent to a total of 18,600,000, representing about 85 million persons. The number of industrial customers of the manufactured gas division actually declined; the number using natural gas increased slightly. The total for the two divisions remained unchanged, despite the large increase in quantity of fuel gas purchased.

The accompanying charts and tables show the important factors in the trends and indicate the influence of the fuel gas business of the country on total energy supply.

COKE AND BYPRODUCTS

Producers of coke and byproducts established many new records during 1941. The total output of byproduct coke was 58.4 and of beehive coke 6.3 million tons. The byproduct coke output was 8 percent greater than the old record of 1940 and was over 10 percent above the 1929 peak. The production of beehive coke was about double that in the preceeding year, being almost equal to the 1929 output, but only a small fraction of the record yields in World War I when the beehive ovens furnished most of the coke supply of the country.

During every month of 1941 except 28-day February and coal-strike April the output of all coke exceeded December 1940 the previous record month. This means that with demand for steel at capacity, the coke ovens of the country were pushed to their limit for the entire year. The record month byproduct output was in December when 5,186,420 tons of byproduct coke was reported to the U. S. Bureau of Mines.

At the end of 1941 there was one more byproduct oven plant pushing coke than a year earlier. The recovery of ammonia continued at the same eighty works. But the recovery of benzol, toluol, and naphthalene was much wider spread than formerly. Several plants began production of those light oil derivatives for the first time during last year.

The following table indicates an estimated production of 1941 for the major byproducts.

Ammonium sulphate	1,490 million lb.
Ammonia liquor (NH_3)..	63 million lb.
Benzol (all grades)....	145 million gal.
Toluol (all grades)....	29 million gal.
Naphthalene (crude) ...	84 million lb.

The production of all of these was

Gas Industry Statistics (Manufactured Gas)

Source: Estimates of American Gas Association

Customers	1941	1940	Percent Change
Domestic	9,608,000	9,405,000	+2.2
House heating	361,000	305,000	+18.4
Commercial	418,000	413,000	+1.2
Industrial	33,000	35,000	−5.7
Miscellaneous	10,000	9,000	.....
Total	10,430,000	10,167,000	+2.6
Gas sales (M cu. ft.)			
Domestic	198,287,000	198,752,000	−0.2
House heating	66,606,000	68,498,000	−2.8
Commercial	57,947,000	58,356,000	−0.7
Industrial	79,466,000	61,768,000	+28.7
Miscellaneous	2,621,000	2,260,000	.....
Total	404,927,000	389,634,000	+3.9
Revenue			
Domestic	$259,168,000	$258,153,000	+0.4
House heating	43,259,000	43,247,000	0.0
Commercial	49,640,000	48,568,000	+2.2
Industrial	33,733,000	27,653,000	+22.0
Miscellaneous	1,588,000	1,402,000	.....
Total	$387,388,000	$379,023,000	+2.2

Gas Industry Statistics (Natural Gas)

Source: Estimates of American Gas Association

Customers	1941	1940	Percent Change
Domestic (incl. house heating)	7,565,000	7,212,000	+4.9
Commercial	574,000	565,000	+1.6
Industrial	49,000	47,000	+4.3
Total	8,188,000	7,824,000	+4.7
Gas sales (M cu. ft.)			
Domestic (incl. house heating)	417,216,000	419,532,000	−0.6
Commercial	127,975,000	122,544,000	+4.4
Industrial	851,635,000	716,668,000	+18.8
Electric generation	203,510,000	182,948,000	+11.2
Total	1,600,336,000	1,441,692,000	+11.0
Revenue			
Domestic (incl. house heating)	$280,971,000	$283,017,000	−0.7
Commercial	57,083,000	55,923,000	+2.1
Industrial and elec. generation	183,999,000	153,777,000	+19.7
Total	$522,053,000	$492,717,000	+6.0

a record; but the yield per ton of coke processed was not as high in the case of ammonia compounds as in earlier years. This is a result which should be expected because the yield of ammonia suffers slightly when ovens are being operated at a maximum temperature for highest total coke yield.

The large demand for metallurgical coke produced a not unexpected diversion from household to industrial uses. A survey was made by the Bureau of Mines to determine the extent of diversion of domestic coke to metallurgical purposes. The results indicate that in 1941 at least 1.4 million tons, or 19 percent of the total shipments of 1940, seem to have been shifted in this fashion. Since capacity operation of byproduct coke plants will not furnish wanted quantities next year, there will probably be still further increases in beehive coke manufacture and possibly some further diversion from domestic to metallurgical use of the byproduct type of coke.

Turpentine and Rosin

While export shipments continued to decline, domestic consumers increased their requirements for turpentine and rosin. Larger domestic deliveries combined with controlled production under the conservation program served to lower the carryover. Appreciable gains in sales prices were recorded and extension of the loan plan will have a stabilizing effect this year.

Although many export markets remained closed and total outward shipments continued on a declining scale, the turpentine industry made considerable progress last year. For the crop year ended March 31, 1941, production was reported at 566,341 50-gal. bbl. made up of 343,938 bbl. gum and 222,403 bbl. wood turpentine. For the preceding season, production was 604,778 50-gal. bbl. consisting of 382,781 bbl. of gum and 221,997 bbl. of wood. Exports in 1940-41 amounted to 130,855 bbl. as compared with 238,438 bbl. in 1939-40. Domestic consumption for these periods appeared to be 462,731 bbl. and 476,888 bbl. respectively and carryover stocks on March 31, 1941 were 209,910 bbl. or a decline of 10,357 bbl. for the year.

The semi-annual report of the Department of Agriculture shows a further improvement in the statistical position of turpentine in the March-Sept. period last year. Starting with a smaller carryover, production was held to 307,173 bbl. as against 350,192 bbl. in the corresponding months of 1940. Export statistics were withheld in the latter part of the year but from those made public it is certain that foreign trade was sharply curtailed. It may be estimated that domestic consumers accounted for approximately 328,000 bbl. which compares with 266,186 bbl. for the 1940 period. This reduced surplus stocks on Sept. 30 to 170,027 bbl. or a drop of 77,512 bbl. in 12 months.

Conditions in the market for rosins in the early part of the year were none too favorable as the industry faced a declining demand both at home and abroad with an increase in stock holdings. Statistics for the 1940-41 crop year placed production at 2,146,865 500-lb. bbl., exports 535,128 bbl. and apparent domestic consumption 1,306,973 bbl. Stocks increased from 1,569,396 bbl. on April 1, 1940 to 1,874,160 bbl. on March 31, 1941. For the preceding season, production was 2,293,971 bbl., exports 975,880 bbl., and domestic consumption 1,373,063 bbl., with stocks dropping from 1,621,970 bbl. to 1,569,396 bbl. for the period.

The report for the April-Sept. period, however, indicated that despite a continued drop in export buying, rosins had been going into domestic consumption in a larger way. Controls over output had the effect of bringing the six-month total to 967,214 bbl. as against 1,296,119 bbl. in the corresponding interval of 1940. Shipments abroad are estimated to have declined about 45,000 bbl. but domestic consumption was about 796,000 bbl. or 76,000 bbl. over that for the like 1940 period. Stocks also fell off in volume as they were reported at 1,874,160 bbl. on April 1 and 1,784,828 bbl. on Sept. 30.

Improved call for turpentine and rosins had a stimulating effect on values in the latter part of the year with higher sales schedules also aided by the loan program which the Commodity Credit Corp. makes available to producers who comply with the conservation plan.

The 1942 loan value on turpentine will be 55c. per bulk gallon. The loan rates on rosin range from $2.80 per 100 lb. net for G grade to $3.25 per 100 lb. net for WW and X grades, with appropriate differentials for the intermediate grades, and will average $3.05 per 100 lb. net. The loan rates for both turpentine and rosin are 85 percent of parity.

No loans are to be made on turpentine in barrels nor on any grade of rosin lower than grade G. Naval stores on which loans are made must be stored by approved warehousemen at strategic interior and port points.

Supply, Distribution and Carryover of Turpentine

	1941–42 (Apr.–Sept.)			1940–41 (Apr.–Sept.)		
	Total	Gum	Wood	Total	Gum	Wood
		50-gal. bbl.			50-gal. bbl.	
U.S. carryover Apr. 1	209,910	146,735	63,175	220,267	167,943	52,324
Production	307,173	194,915	112,258	350,192	247,497	102,695
Imports [1]	....	....	....	11,008	11,008	....
Available supply	517,083	341,650	175,433	581,467	426,448	155,019
Less carryover Sept. 30	170,027	124,994	45,033	247,539	198,330	49,209
Appar. total consumption	347,056	216,656	130,400	333,928	228,118	105,810
Less exports [1]	....	....	....	67,742	53,207	14,535
Appar. U.S. consumption	347,056	216,656	130,400	266,186	174,911	91,275
U.S. carryover Apr. 1	209,910	146,735	63,175	220,267	167,943	52,324
U.S. carryover Sept. 30	170,027	124,994	45,033	247,539	198,330	49,209

[1] Figures not available.

Supply, Distribution and Carryover of Rosin

	1941–42 (Apr.–Sept.)			1940–41 (Apr.–Sept.)		
	Total	Gum	Wood	Total	Gum	Wood
U.S. carryover Apr. 1	1,874,160	1,653,235	220,925	1,569,396	1,409,649	159,747
Production	967,214	662,417	304,797	1,296,119	819,992	476,127
Imports [1]	....	....	....	....	....	....
Available supply	2,841,374	2,315,652	525,722	2,865,515	2,229,641	635,874
Less carryover Sept. 30	1,784,828	1,623,693	161,135	1,838,945	1,650,137	188,808
Appar. total consumption	1,056,546	691,959	364,587	1,026,570	579,504	447,066
Less exports [1]	....	....	....	305,789	175,110	130,679
Appar. U.S. consumption	1,056,546	691,959	364,587	720,781	404,394	316,387
U.S. carryover Apr. 1	1,874,160	1,653,235	220,925	1,569,396	1,409,649	159,747
U.S. carryover Sept. 30	1,784,828	1,623,693	161,135	1,838,945	1,650,137	188,808

[1] Figures not available.

Oleoresin stored at approved central distillation plants will also be eligible for loan.

The loans will be available from Jan. 1 to Dec. 31 and will bear interest at the rate of 3 percent per annum. The period of peak production of gum naval stores is from April to September, during which time about 70 percent of the crop is harvested. Up to April 1, 1943, producer-borrowers will be given an opportunity to obtain the release of equivalent quantities of 1942 naval stores, not exceeding quantities pledged, by payment of an amount equal to the loan value, plus accrued charges and interest.

Reported Consumption of Turpentine

	1941–42 (Apr.–Sept.) bbl.	1940–41 (Apr.–Sept.) bbl.
Adhesives & plastics	305	121
Automobiles & wagons	244	276
Chemicals & pharmaceuticals	31,907	16,281
Foundries & f'dry supplies	546	382
Furniture	269	238
Insecticides & disinfectants	204	205
Linoleum & floor covering	....	30
Oils & greases	145	47
Paint, varnish & lacquer	29,090	25,888
Printing ink	110	86
Railroads & shipyards	3,763	2,968
Rubber	76	108
Shoe polish & shoe mat'ls	4,424	5,584
Soap	....	7
Other industries	216	498
Total industrial reported	71,299	52,719
Not accounted for [1]	275,757	213,467
Apparent U.S. consumption	347,056	266,186

[1] Principally unreported distribution of turpentine through retailers who sell in small quantities to ultimate consumers. Increase in "not accounted for" due largely to lack of information on exports.

Reported Consumption of Rosin

	Season 1941–42 (Apr.–Sept.) 500-lb. bbl.	Season 1940–41 (Apr.–Sept.) 500-lb. bbl.
Abattoirs	519	317
Adhesives & plastics	12,590	8,295
Asphaltic products	1,008	698
Automobiles & wagons	332	294
Chemicals & pharmaceuticals	71,818	91,757
Ester gum & synth. resins	116,054	61,318
Foundries & f'dry supplies	11,719	3,854
Furniture	4	8
Insecticides & disinfectants	2,991	2,200
Linoleum & floor covering	7,490	18,274
Matches	531	2,759
Oils & greases	35,665	14,273
Paint, varnish & lacquer	128,605	78,755
Paper & paper size	209,598	166,296
Printing ink	9,024	6,460
Railroads & shipyards	3,699	1,322
Rubber	4,768	2,929
Shoe polish & shoe mat'ls	6,152	3,868
Soap	126,240	96,403
Other industries	3,569	2,771
Total industrials reported	752,376	562,851
Not accounted for [1]	304,170	157,930
Apparent U.S. consumption	1,056,546	720,781

[1] Principally unreported industrial consumption of rosin and rosin for distribution through retailers who sell in small quantities to ultimate consumers. Increase in "not accounted for" due largely to lack of information on exports.

As in previous years, the loan program will provide for the liquidation of stocks under matured loans at stipulated minimum percentages of the signatory distributors' sales. During the 1942 producing season, sales of 1940 and 1941 rosin stocks made through regular trade channels will be at prices not less than parity. Parity based on the Nov. 15 index is \$3.59 per 100 lb. net for average of the nine grades of rosin eligible for loan. Loan stocks of the 1938 and 1939 crops are about 306,000 bbl. Commodity Credit Corp. sales of rosin last year were considerably over 700,000 bbl.

Registration particulars of the United Kingdom Naval Stores Association were made public in the latter part of the year. The company is limited by guaranty and without share capital, "to cooperate with the appropriate authorities in connection with the allocation and distribution in the United Kingdom of certain products and to protect the interests of the importers of such products." It may be assumed, the item continues, that the organization owes its origin to the current scarcity of rosin and, to a lesser degree, of turpentine and pine oil, and to the steps taken by the Government to secure additional supplies from the United States on Lend-Lease terms.

The new Association, judging from the membership of its committee, is representative of both importing and consuming interests, and should be able to keep the Import Licensing Department authoritatively posted on the magnitude of United Kingdom demand for rosin, turpentine, etc., and to distribute the available supplies in the best national interest with due recognition of the needs of the smaller users.

Lead and Zinc Pigments

Sales of lead and zinc pigments rose sharply last year with some products establishing new records and most others falling but little under previous highs. Dry white lead found a wider market than in any preceding year but lead in oil while gaining ground did not regain the popularity it enjoyed some years ago. Use of leaded zinc oxide and zinc sulphate is expanding.

In view of the rise in activities at paint and rubber plants last year, it was logical to look for something like a comparable growth in the output of most of the lead and zinc pigments and the Bureau of Mines has verified this deduction in its report which states that statistics for the year indicate new records were established for some of the pigments. Larger volume of sales was general but the rate of increase covered a considerable range, varying from 14 percent in the case of lithopone to about 71 percent for basic lead sulphate. Orange mineral actually made the highest relative gain in sales but the total amount involved was only 250 tons.

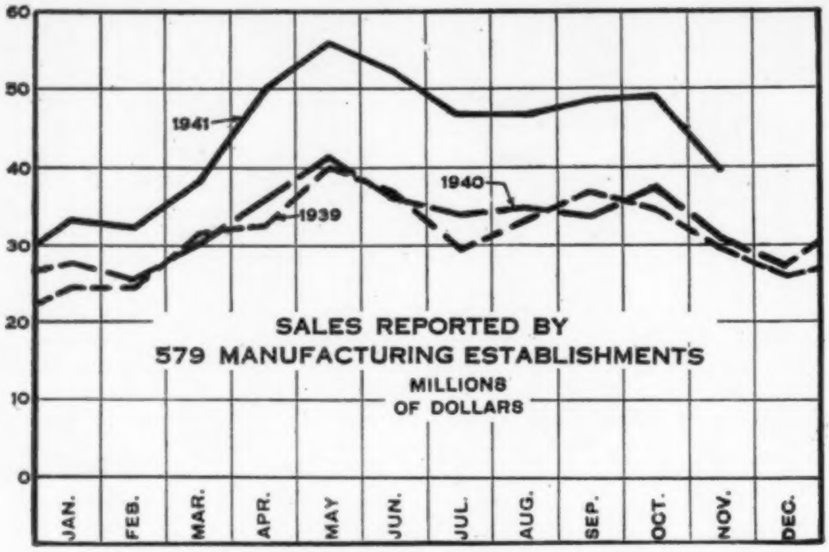
The relation of quantities sold in 1941 to those for earlier periods was as follows: red lead advanced 23 percent over 1940 and was 21 percent above the previous record for 1929; litharge gained 32 percent over the previous record for 1940; basic lead sulphate was 71 percent above 1940 and was the largest since 1930; white lead (dry and in oil) advanced 40 percent over 1940 and, with the exception of 1936, was the greatest since 1929. It is noteworthy that sales of dry white lead in 1941 were the highest on record, having advanced 82 percent over 1940. Those for white lead in oil, on the other hand, although 15 percent above 1940, were 10 percent below the average for the ten-year period 1930-39, and 54 percent below that for the ten-year period 1920-29. In 1941 they were higher than in only four other years since 1904, i.e., 1932, 1933, 1934 and 1940.

Leaded zinc oxide has gained in popularity in recent years and has established several records, that for 1941 being the latest; it was 52 percent above the previous record for 1940. Zinc oxide (lead-free) sales in 1941 were 32 percent above 1940 and the highest since 1929, having been exceeded in only four years in the prosperous twenties. Lithopone sales, too, were the largest since 1929, having risen 14 percent over 1940, and were exceeded only in 1927-29. Zinc sulphate, like leaded zinc oxide, has made new records during several recent years. Sales of this salt in 1941 were 63 percent above the previous record for 1940.

The most important items in

foreign trade in lead and zinc pigments for the first nine months of 1941 (12 months for 1940 shown in parentheses) were as follows: Exports of white lead (dry and in oil) totaled 1,975 (1,360) short tons; litharge 2,003 (1,586) tons; and red lead 2,050 (1,336) tons. Exports of lithopone aggregated 16,954 (14,298) tons and zinc oxide 5,404 (3,239) tons. Imports of zinc oxide (dry and in oil) were 117 (318) tons. Figures on imports and exports are obtained from records of the Bureau of the Census. Beginning with October 1941 these statistics will be held confidential.

Sales of paint, varnish, and lacquer for the first 11 months of last year were valued at $513,690,393 as compared with $384,207,659 for the corresponding period of 1940. These totals are on a basis of 680 reporting establishments and they indicate a gain of more than 30 percent for the year.



Sales of Paints, Varnish, and Lacquer

Domestic Sales of Lead and Zinc Pigments, 1940–1941

	1940	1941
Basic lead sulphate or sublimed lead	[1] 6,200	[1] 10,600
Red lead	42,200	52,100
Orange mineral	137	250
Litharge	89,841	[3] 118,600
White lead:		
Dry	30,115	54,800
In oil [2]	50,447	57,900
Zinc oxide	113,213	149,100
Leaded zinc oxide	45,362	69,100
Lithopone	151,802	173,500
Zinc sulphate	11,937	19,500

[1] Exclusive of basic lead sulphate used for the manufacture of leaded zinc oxide which is included in tonnages shown for that pigment.
[2] Weight of white lead only.
[3] Includes some basic lead acetate used for the same purpose as litharge.

Chemicals for Latin America

Allocations of materials for Latin American requirements, as announced on Jan. 15 by Douglas MacKeachie, director of the Division of Purchases, OPM, are as follows for the first quarter of 1942:

Acetone	100,000	lb.
Ammonia, anhydrous	795,000	lb.
Ammonium sulphate	10,100,000	lb.
Aniline	95,000	lb.
Carbon tetrachloride	140,000	lb.
Caustic soda	35,000,000	lb.
Chlorine	500,000	lb.
Chromium tanning Chemicals	565,000	lb.
Citric acid	620,000	lb.
Copper sulphate	17,500,000	lb.
Formaldehyde	175,000	lb.
Glycerine	350,000	lb.
Methyl alcohol	55,000	gal.
Phosphorus	69,000	gal.
Plastics	150,000	lb.
Potash salts	3,500,000	lb.
Potassium permanganate	50,000	lb.
Soda ash	47,500,000	lb.
Sulphuric acid	2,000,000	lb.
Superphosphate	17,500,000	lb.
Tungsten	2,500	lb.
Platinum	4,500	oz.
Rayon	3,300,000	lb.
Nickel	15,000	lb.
Farm equipment	$13,000,000	

Bauxite Production

PRODUCTION of bauxite in the United States in 1941 exceeded the previous peak reached in the World War year of 1918 by nearly 50 percent and surpassed the output of 1940 by 105 percent, according to preliminary figures compiled by the Bureau of Mines, United States Department of the Interior.

Output in 1941 totaled an estimated 899,500 long tons compared with only 438,913 tons in 1940. Imports of bauxite during the first 9 months of 1941 totaled 749,264 tons, a tonnage considerably greater than ever received during any previous full 12-months period. Domestic production and importations in 1942 are expected to greatly surpass those of 1941. Consumption of bauxite in the United States also broke all records in 1941 and is estimated to have totaled approximately 1,700,000 tons compared with 1,072,000 tons in 1940. It is estimated that the aluminum industry consumed about 70 percent of this bauxite and the chemical, abrasive (including American-owned plants in Canada), and other industries about 16, 12, and 2 percent, respectively.

Of the estimated 1941 bauxite production (dried bauxite equivalent, based on monthly mine shipments), Arkansas contributed 92 percent and Alabama, Georgia, and Virginia the remaining 8 percent. The greatest increase in mine production over that of 1940 was in Arkansas and Alabama. The 1941 production data are based on monthly canvasses conducted by the Bureau of Mines for the Office of Production Management, the usual preliminary annual canvass was not made. No reliable figures are available at this time on the value of bauxite shipped. It is probable, however, that the value on all grades of domestic ore shipped in 1941 was more than double that of 1940 ($2,578,968).

According to the Department of Commerce, during the first 9 months of 1941 bauxite imports increased 75 percent compared with the corresponding 1940 period and exports of bauxite and bauxite concentrates increased 72 percent. Of the 1941 imports, Surinam furnished 85 percent. British Guiana 10 percent, and the Netherlands Indies 5 percent. Receipts from Surinam and British Guiana totaled 637,579 and 75,603 tons, respectively, advances of 52 and 731 percent over those of the 1940 period. In addition to bauxite, 28 long tons of aluminum hydroxide (refined bauxite) valued at $3,002 were imported from January through September 1941.

Of the bauxite exports during the first 9 months of 1941, 86,557 tons were classified as bauxite and other aluminum ores, 11,448 tons as other bauxite concentrates, and 18 tons as alumina. As usual Canada probably was consigned all but a small quantity of these exports. Due to a recent ruling of the Bureau of the Census, no foreign trade statistics later than those given above (for the first 9 months of 1941) will be released until after the war.

MINERAL ACIDS
(Continued from page 84)

The question of acid balance in the production of military explosives is an interesting one, as was pointed out in our issue of February 1941. During the last war, weak acid produced in the concentration of nitric acid and by the denitration of spent mixed acid could be reacted with sodium nitrate for the manufacture of fresh nitric acid. Now that nitric acid is made almost entirely by ammonia oxidation, this outlet for the weak acid no longer exists. Not all the spent acid can be reconcentrated sufficiently to avoid the introduction of new oleum into the system, and there must therefore be a continuous withdrawal of weak acid equivalent to the new oleum intake, less the losses in the nitration processes and in reconcentration.

To take care of this problem, the plan has been to ship the excess weak acid to pickling and fertilizer plants. So far, the build-up of acid stocks for military explosives manufacture has prevented much of this weak acid from becoming available, but there will be a considerable quantity once the situation has become stabilized, unless recovery is more efficient than most people expect.

Most of the construction at acid plants in 1941 was not capacity-increasing construction, but was rather for the purpose of changing the character of the acid. Numerous oleum towers were added at contact plants, and a considerable number of concentrators were built. New acid capacity put into operation during the year is estimated to have totalled 1,000–1,100 tons per day of acid on the basis of 100 percent H_2SO_4. The current year is expected to see more oleum tower and concentrator construction, with an estimated 1,700 daily tons of new acid capacity (100 percent basis) going into operation.

Construction started in 1941 on a new large-scale pilot plant for the recovery of elemental sulphur from sour gas in the southern Arkansas gas field. The process to be used is understood to be a modification of the old Claus kiln, and to be licensed under the Norwegian Orkla patents.

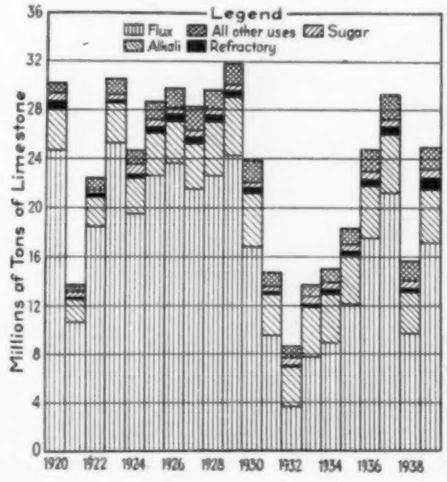
As pointed out in our issue of February 1941, large scale increase in nitric acid capacity was under way or completed in 1941. An estimate of the increase cannot be given at this time, other than to state that it multiplies the normal peace-time capacity by several fold. Requirements for hydrochloric acid have not been much affected by defense needs, but one interesting trend has been noted. Part of the Southern synthetic HCl capacity has been converted to the furnace process, making HCl from sulphuric acid and salt, in order to release chlorine for other purposes.

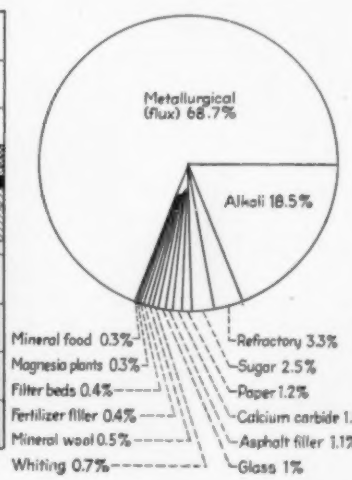
Limestone in Process Industries

An excellent summary of the use of limestone and dolomite in the chemical and processing industries has appeared in U. S. Bureau of Mines Information Circular No. I.C. 7169, by Oliver Bowles and Mabel S. Jensen, from which the accompanying brief abstract of tabular material has been taken.

Because of its ready availability and the multitude of uses for which it is employed, production of limestone exceeds that of any other rock. In 1939 limestone sold or used in the United States (including that employed in cement and lime manufacture) exceeded 139,000,000 tons or about 75 percent of the quantity of all kinds of stone sold or used during that year. Although the major consumption of limestone is in the form of concrete aggregate, road material and railroad ballast, or as a fluxing stone in blast furnaces, for cement and lime manufacture, as agricultural limestone, as riprap for shore protection, for harbor work and spillways at dams, and as building stone, nevertheless, about 25,000,000 tons (or about 35 percent of the total commercial limestone handled annually) is consumed by the manufacturing and chemical industries.

The accompanying table shows quantities of limestone used annually in the principal chemical and process outlets, from 1929 to 1939. The table is taken from a more extensive one covering 1920 to 1939, and showing also the value of the limestone used in the industries listed. The chart summarizes tonnages used by the largest consumers of the group from 1920 to 1939 and details 1939 uses.





Short Tons of Limestone Sold or Used in Principal Chemical and Processing Industries, 1929–39

(Taken from a tabulation covering 1920–39, which lists also value, appearing in U. S. Bureau of Mines I. C. 7169)

	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939
Alkali	5,004,930	4,436,160	3,340,290	3,211,770	4,193,650	3,814,060	4,090,980	4,394,670	4,860,520	3,634,050	4,655,960
Asphalt filler	344,880	430,290	247,450	177,110	126,780	172,170	152,040	210,370	351,590	288,590	265,710
Calcium carbide	339,510	364,750	164,180	188,050	117,740	305,600	287,340	348,170	472,240	246,010	274,890
Glass	257,370	224,180	159,220	108,720	199,720	161,220	250,930	265,890	274,770	170,560	240,840
Metallurgical flux	24,337,280	17,021,350	9,674,800	3,945,170	7,982,560	9,230,880	12,191,660	17,724,880	21,311,250	9,692,130	17,271,560
Mineral wool	83,920	64,850	73,640	43,180	55,160	68,820	96,940	180,320	146,330	86,400	123,720
Paper	273,880	248,790	194,310	152,710	196,440	202,160	188,090	255,880	322,810	223,450	302,620
Refractories	516,400	453,350	268,500	72,240	196,540	300,180	321,800	401,320	576,900	263,930	824,930
Sugar	487,990	414,340	453,640	507,980	607,990	479,900	460,460	540,470	566,620	619,910	621,730
Limestone whiting	125,430	119,350	73,420	76,020	93,070	97,340	147,910	179,110	194,060	145,170	175,460

Price Trends for Chemicals

The price trend for chemicals was on a downward course from 1937 until the latter part of 1939 when the trend was reversed and a sellers market has existed since that time so that values might have advanced sharply had not producers voluntarily held them in check and kept speculative trading to a minimum. The course of oils and fats has been more erratic with values at first depressed by the closing of large consuming markets but large-scale buying set in and runaway prices forced the establishment of ceilings.

In the majority of cases, tonnage chemicals were delivered to contract holders last year at the price levels which had applied in the preceding year. In consequence, a goodly part of the years output changed hands with a stabilizing effect on the average price level. It was primarily a sellers market as demand, generally considered, ran ahead of supply and this fact added to rising production costs, could easily have led to an inflationary market had not producers voluntarily kept values under control. The strength of the market was demonstrated by the fact that a few chemicals which were in plentiful supply early in the year were soon in a position to command full quoted figures where they had been selling at bargain levels. When the war in Europe started, it immediately brought up memories of the hectic conditions which ruled in domestic markets in the 1914-1918 era. Producers were quick to take action against the possible recurrence of that situation. In the first place, they made no attempt to modify their sales schedules and further took precautions to prevent sizeable tonnages from finding their way into the resale market. That policy was adhered to throughout the past year and to it was due the orderly position which the market displayed at all times.

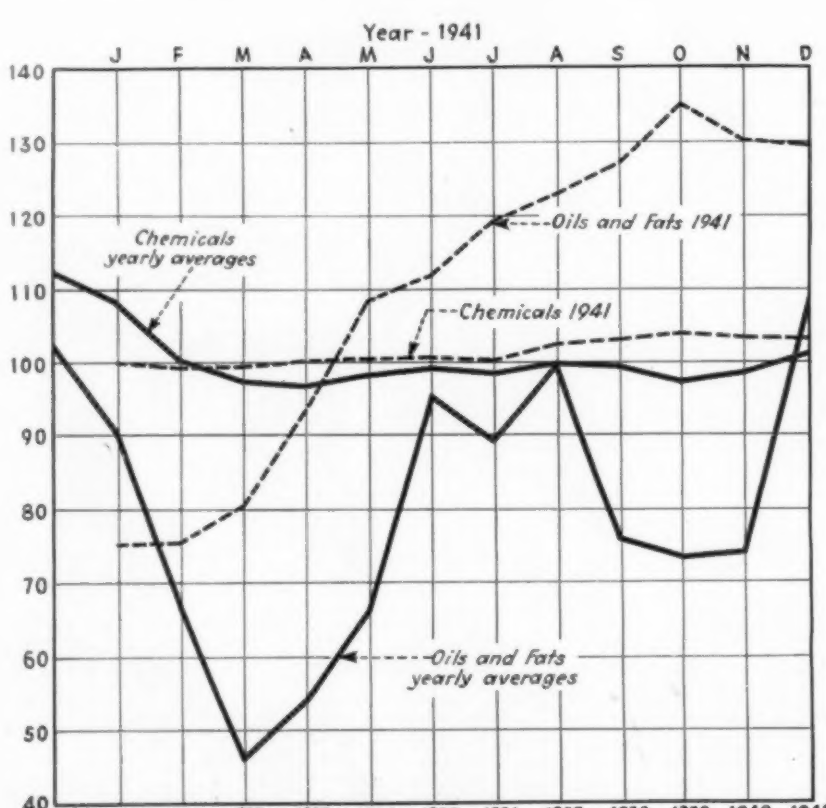
It is true that some goods reached the resale market and many consumers, especially smaller ones who were not protected by contracts with producers were forced to seek supplies wherever they were to be had and they were willing to pay the high prices asked because the alternative was to cease plant operations. However, such business was of the small-lot variety and did not bulk large in the grand total of chemical trade. A fair share of export business also was put through by second hands and much of this trading was transacted at unit prices far above those quoted by producers.

As the year advanced, government action became increasingly important both with regard to distribution and prices for chemicals. In some instances, distribution controls automatically acted as price controls. The placing of chlorine and toluol under full allocation and the taking of full production of other chemicals for government use may be cited as examples. Another innovation in the way of market regulation consisted in entering into agreements with producers to maintain price levels at specified levels which made it unnecessary to issue formal orders. The most striking price development of the year, however, is found in the direct action taken by government agencies to establish maximum values for a wide range of chemicals.

Toward the close of the year, prices for oils and fats were moving up so fast that on Dec. 12 the Office of Price Administration announced that a ceiling had been set for all fats and oils with the exception of butter. The order forbade the sale of these products at prices above those prevailing on Nov. 26. That date was selected because immediately thereafter, speculative trading had forced sharp upward revisions. Restrictions likewise were placed on inventories to hold them to a three months supply. After the turn of the year this restriction was modified. Following the establishment of the price ceilings the markets were greatly confused and in the case of cottonseed oil trading in futures on the New York Produce Exchange was temporarily suspended. Sellers of some of the other oils also practically withdrew from the market not only because of the price limitation but also due to incomplete understanding of the regulation regarding inventories. In December the price situation became more involved as shipments of oil from far eastern points was interrupted.

Prices for Chemicals and Oils and Fats

	Chemicals,	Oils and Fats
1941	101.69	109.24
1940	98.90	71.22
1939	97.64	75.42
1938	99.86	75.93
1937	100.00	100.00
1936	98.81	89.40
1935	99.64	95.60
1934	98.74	66.09
1933	97.10	54.20
1932	97.91	46.50
1931	100.55	67.14
1930	108.60	90.82
1929	112.32	102.74



Foreign Trade in Chemicals

International commerce in general was further dislocated last year as the extension of war areas forced the breaking of trade relationships and the closing of several ports to general commerce. Home requirements also rose which reduced surpluses for export. Our foreign trade in chemicals was of record proportions on the export side but import volume declined.

STATISTICS for exports and imports of chemicals and related products were published for the first three quarters of the year, then it was announced such data would no longer be made public. Hence it is not possible to draw accurate comparisons with the 1940 totals. It is evident, however, that our export trade was of record proportions as the nine-months figures showed a gain of approximately 16 percent over the corresponding totals for the preceding year when the previous high was recorded. Our import trade failed to make as encouraging a showing for the latest available figures imply a drop in receipts of more than 5 percent with the probability that the decline was more pronounced for the entire year.

While the United Kingdom and Canada continued to hold the ranking positions in our export trade there were reports that Russia had been buying heavily in our markets especially in the latter part of the year. In August this country renewed the commercial agreement with the Soviet Union which was originally negotiated in 1937. In later months several credits were opened for Soviet purchases, both direct and under the Lend-Lease Act, and according to unofficial reports, chemicals figured prominently in such purchases.

Exports of chemicals and related products as included in Group 8 of the Bureau of Foreign and Domestic compilations, reached a total of $196,045,130 for the first three-quarters of last year as compared with $168,987,898 for the corresponding period of 1940. Every division within the group showed a gain for the year with the exception of fertilizers and fertilizer materials which fell but little below the value reported for the preceding year. Only moderate gains were reported for soap and toilet preparations. The largest increase was noted in outward shipments of explosives and fuses which was to be expected.

Shipments of products included in the explosives group reached abnormally high totals but ordinarily these products do not figure prominently in our trade with outside countries, hence the high rate of gain may be ascribed wholly to war-time influences. For other groups the call for our products was distributed in a fairly even way over a large number of commodities which might mean that they were consumed in larger amounts through direct war demands. A large part of this increased buying, however, resulted from the dislocation of foreign trade which transferred orders from their usual course to countries where the goods were available. As our own demands for chemicals increased and shortages became numerous, greater difficulty was found in taking care of export demand. Inquiries for moderate sized lots often found buyers willing to pay prices far above the regular quotations and in some cases the unsettled conditions reported in the resale market were due to insistent demand for goods for export. The higher unit value prevailing also must be considered in comparing such trade with previous periods as the increase in value for exports was larger than that for volume.

Imports of chemicals for the nine-month period last year reached a value of $44,802,071 which compares with $47,373,659 for the comparable months of 1940. Arrivals of medicinal and pharmaceutical products nearly doubled those received in the preceding year and industrial chemicals also were received in larger volume. Coal-tar chemicals have shown a declining trend from the latter part of 1939 as our former suppliers have been unable to make shipments in the accustomed volume and in the interim our own production has been stepped up so that our dependence on foreign supplies has been lessened. The most pronounced drop in chemical imports last year was found in the fertilizer group. This no doubt followed the sharp rise in demand for nitrogen in other countries.

Export Trade in Chemicals By Groups—1930-1941

Value in $1,000	1941 9 months	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930
Coal-tar products	$22,374	$28,449	$14,612	$9,890	$14,878	$13,776	$13,959	$13,264	$12,423	$8,752	$10,347	$17,556
Medicinal and pharmaceutical preparations	28,817	29,269	22,317	17,079	17,979	14,393	12,239	10,973	9,816	10,027	15,104	17,801
Chemical specialties	30,320	38,449	36,041	28,953	27,526	20,456	12,868	11,612	10,663	9,949	13,754	15,589
Industrial chemicals	43,415	53,646	36,514	25,173	27,505	22,046	23,627	21,683	16,802	14,954	19,774	23,015
Pigments, paints, varnishes	18,872	22,434	22,761	18,655	21,544	17,788	16,345	14,214	11,834	10,366	15,127	21,689
Fertilizers and materials	14,299	20,224	17,141	16,531	16,954	17,750	14,809	12,543	8,269	8,653	13,011	15,284
Explosives, fuses, etc	30,060	20,868	4,999	3,666	3,863	2,618	2,439	2,149	1,527	1,282	1,734	2,950
Soap and toilet preparations	7,888	8,526	10,311	8,963	9,164	8,075	7,028	6,180	5,436	6,422	11,283	13,970
Total	$196,045	$221,865	$164,656	$128,910	$139,448	$116,902	$103,493	$92,618	$76,760	$70,405	$100,134	$127,854

Import Trade in Chemicals By Groups—1930-1941

Value in $1,000	1941 9 months	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930
Coal-tar products	$6,797	$9,034	$18,942	$15,970	$18,353	$15,212	$13,557	$11,847	$9,997	$9,157	$11,162	$16,273
Medicinal and pharmaceutical preparations	6,950	4,604	5,507	4,328	4,894	4,890	4,127	4,234	3,605	2,530	3,973	4,947
Industrial chemicals	11,242	13,334	17,632	16,794	26,447	20,960	16,145	17,469	17,236	14,440	17,198	23,299
Pigments, paints, varnishes	586	995	1,519	1,368	2,179	1,971	2,109	1,694	2,033	1,446	2,016	2,612
Fertilizers and materials	16,572	27,207	32,455	36,496	46,704	33,394	28,560	26,029	24,573	17,858	44,732	59,150
Explosives	830	437	409	655	864	738	827	588	244	338	520	910
Soap and toilet preparations	1,825	2,640	3,015	2,409	3,131	2,811	3,387	3,203	2,184	2,005	3,027	4,719
Total	$44,802	$58,251	$79,479	$78,020	$102,571	$79,976	$68,716	$65,058	$59,8[illegible]4	$47,776	$82,626	$111,904

PLASTICS

(*Continued from page* 91)

quently the output for the year was in the neighborhood of the 4,400,000 lb. produced in 1940. The prices of polystyrene resins range between 45 cents and 60 cents per lb. Certain grades are now available at 36 cents per lb.

The urea resin production last year is estimated to have been 28,780,000 lb. which compares with 17,400,000 lb. of the previous year. And total production in 1941 would have been much larger but for a shortage of formaldhyde as the plants were operating somewhat below capacity. Of this output about 8,000,000 lb. was used in adhesives, 3,000,000 for treating textiles, paper, etc. and 1,000,000 for laminating. The price for molding material remained unchanged. Present prices for the material in granular form are from 27½ cents to 35 cents per lb. The liquids resins sell in the range from 22 cents to 24 cents per lb.

Perhaps as much as 20 percent of the urea resin output was for defense purposes. The most important use was for glue. This adhesive is empoyed in formed plywood fuselages, wing and nose for airplanes. This demand for adhesive accounts for most of the increased output of urea resins during the year.

Melamine resin molding powder was introduced last year for the first time. The laminating and coating compounds had been commercialized the previous year by American Cyanamid Co. It is more heat-resistant than the urea or thiourea resins, does not scratch or mar so easily, and is less affected by fruit juices, alkalis, acids and common solvents. Prices are higher than for the corresponding urea—formaldehyde resins. They average almost 55 cents per lb.

Acrylic resins are produced by du Pont, and Rohm & Haas. The plant capacity of the industry has been considerably increased. During the year the new fabricating plant of Rohm & Haas commenced production to service the great airplane plants on the West Coast. Applications include: airplane, tank, and marine windows and clear enclosures, dentures, teeth and inlays, dresser sets, cutlery handles, adhesives and protective coatings, displays and signs, furniture and trim. The price range is between 85 cents and $2.25 per lb.

Cast phenolic resins were made by Catalin Corp. and its licensees, Marblette, Monsanto, Bakelite, Joanita, and A. Knoedler Co. Production continued to increase, going from 6,953,103 lb. to about 7,500,000 lb. However, during the last few months of the year the rate of production fell off materially due to war requirements for the raw materials. Prices strengthened somewhat. The average price for the cast phenolic in 1940 had been 44½ cents per lb. In October 1941 prices were increased. They then averaged about 50 cents per lb.

During the year Catalin Corp. purchased the land, building and equipment of the U. S. Tar Products, Inc. at Matawan, N. J., for the production of raw materials for use in manufacturing liquid resins.

The molding phenolic resins made another enormous gain, reaching approximately 112,000,000 lb. of which 50 percent or 56,000,000 lb. was resin. Prices ranged from 12 to 60c. per lb.

ORGANIC CHEMICALS

(*Continued from page* 96)

Germany, was eased by the entrance of the Koppers Co. and Technical Associates, Inc., into the production of this commodity. Tricresyl phosphate output was expanded at the plant of the Ohio Apex, Inc. and Carbide & Carbon Chemicals Corp. spent $1,500,000 for expansion of one of its organic chemical plants.

In fine chemicals, the Charles Pfizer & Co. spent $1,000,000 on the expansion and improvement of its plant, while Merck & Co. announced that the first unit of its new southern vitamin and fine chemicals plant had been placed in operation. The entire plant is scheduled to be operating by May 1942.

During 1941 probably some 200,000 lb. of nicotinic acid was required for flour fortification and 20,000 lb. for pellagra treatment. In 1940 a total of only about 10,000 lb. of nicotinic acid was manufactured. The National Oil Products Co. announced in August a plan to construct the first unit of a chemical and vitamin plant at an estimated cost of $100,000. Newport Industries, Inc. erected a plant in the South for production of terpene chemicals.

Armour & Co. plans for the expansion of neo-fat production were well under way at the end of the year. New facilities will provide for an additional 30,000,000 lb. annually.

RAYON AND FIBERS

(*Continued from page* 97)

pared with about 61 percent for viscose. Of the staple production, somewhat less than 20 percent is believed to have been acetate.

The trends which we noted in our review of February 1941 in regard to synthetic fibers other than those derived from cellulose are continuing as previously noted. At its two nylon plants DuPont projected a 16,000,000 lb. per year capacity and the first unit of the new Martinsville plant went into operation late in 1941. Recently the company promised the addition of another 4,000,000 ton unit at Seaford, for operation late in 1942. An important phase of the nylon situation is DuPont's development of a process for the essential adipic acid, which does not depend on the critical material, phenol.

This nylon capacity was believed to be sufficent to take care of perhaps two-thirds of the country's requirements for full-fashioned hosiery. As this issue goes to press, however, the WPB has announced that most if not all of the nylon supply will be required for parachutes, so that future hosiery requirements will have to be met with rayon, lisle, cotton and wool. Unfortunately for the hosiery trade, most of the high tenacity rayon yarns will not be available either, being required for the manufacture of airplane and truck tires, and self-sealing gasoline tanks.

Ford Motor Co. announced continuing work on soybean protein fiber, with the building of a plant for large-scale semi-commercial production. Already commercialized, the casein-derived fiber of National Dairy's Aralac division extended its applications, while its makers and users continued to explore possible uses, and the means for attaining the special properties needed by each application. Still another development in the protein fiber field was the announcement by the Western Regional Research Laboratory of the U. S. Department of Agriculture of the discovery of a process, for which public patents are being sought, wherein the molecules of a variety of proteins, including waste materials, can be oriented suitably for fiber production by treatment with certain synthetic detergents. Still in the laboratory, commercial feasibility is yet to be proved, but the process seems well worth further careful investigation.

Priority Orders For Chemicals

Orders and forms which are used by the Division of Priorities in administering the priorities system generally fall into four main divisions:

"P" orders are used to assign limited blanket preference ratings to a company or companies engaged in important work.

"M" orders are used to impose priority control over some raw materials.

"E" orders are used to impose some form of distribution control over equipment.

"L" orders are used to restrict the production of less-essential civilian goods.

The regulation of prices is effected by the issuance of price schedules which are numbered in numerical order as they appear and the number serves to identify the individual order. The schedules establish price ceilings for the chemicals in question and usually contain details concerning quantity prices, packaging, and other price factors.

"M" Orders

Order	Material	Effective Date
M-2	Magnesium	Mar. 24, 1941
M-2-a	Supplementary order—extends M-2 to Sept. 30, 1941	Mar. 24, 1941
M-4	Neoprene—expired June 30, included under provisions of M-13 issued June 9	Apr. 10, 1941
M-7	Borax and boric acid—Supplementary order extends M-7 to July 30; later extended to Aug. 30 when it expired	June 9, 1941
M-10	Polyvinyl chloride	June 9, 1941
M-12	Cotton linters—Control extended to July 31, 1942	Sept. 10, 1941
M-16	Tricresyl and triphenyl phosphates	Aug. 30, 1941
M-19	Chlorine	July 26, 1941
M-25	Formaldehyde, paraformaldehyde, hexamethylenetatramine and synthetic resins	Aug. 23, 1941
M-27	Phenols	Aug. 20, 1941
	Amendment	Nov. 12, 1941
M-28	Chlorinated hydrocarbon refrigerants	Aug. 22, 1941
M-30	Ethyl alcohol and related compounds	Aug. 28, 1941
M-31	Methyl alcohol	Aug. 28, 1941
M-32	Potassium perchlorate	Aug. 28, 1941
M-33	Potassium permanganate	Aug. 28, 1941
M-34	Toluene	Aug. 28, 1941
M-35	Phosphorus oxychloride	Aug. 30, 1941
M-37	Rayon yarn	Sept. 13, 1941
M-37-a	Rayon yarn—Supplementary interpretation order	Oct. 1, 1941
M-40	Sperm oil	Oct. 16, 1941
M-41	Chlorinated hydrocarbon solvents	Oct. 15, 1941
M-46	Chlorinated rubber	Nov. 1, 1941
M-30	Ethyl alcohol and related products—amendment	Dec. 31, 1941
M-10	Polyvinyl chloride amendment	Dec. 31, 1941
M-19	Chlorine allocation order	Dec. 20, 1941
M-71	Fats and oils conservation order	Jan. 31. 1942
M-25	Formaldehyde amendment	Dec. 31, 1941
M-28	Hydrocarbon refrigerants distribution order	Dec. 31, 1941
M-54	Molasses—supply and distribution order	Dec. 31, 1941
M-57	Tung oil distribution order	Jan. 8, 1942
M-66	Cashew nut shell	Jan. 13, 1942
M-44	Titanium pigments to conserve supply	Jan. 7, 1942
M-34	Toluene amendment to further control allocation	Dec. 30, 1941
M-52	Sulphite wood pulp allocation program	Jan. 9, 1942

"P" Orders

Order	Material	Effective Date
P-43	Research laboratory supplies and equipment	Aug. 28, 1941
P-62	Material for production of laboratory equipment and reagent chemicals	Nov. 15, 1941
P-62	Correction of rating from A-1-F to A-5	Jan. 8, 1942

"L" Orders

L-11	To restrict use of chlorine in pulp and paperboard	Nov. 15, 1941
L-20	To limit use of cellophane and transparent materials	Nov. 8, 1941
L-20	Amended to add to restricted list	Jan. 10, 1942

Acetone

Order M-30, effective Aug. 28 to Nov. 30, 1941, placed acetone under full priority control. Ratings were assigned to defense orders which must be given preference. Order M-30 extended indefinitely on Dec. 10.

Price schedule No. 36 established level at 7c a lb. delivered, in tank cars in eastern territory. Carlot price in drums set at 8½c a lb. delivered, containers included. Dec. 11, producers were asked to refrain from quoting prices for delivery after Jan. 1, 1942 until further notice. Dec. 20, price raised to 15.8c a lb. delivered in tank cars where cost of molasses is $2.50 per 100 lb. of sugar content. This became effective Jan. 1, 1942.

Acid Acetic

Price schedule No. 31, effective Sept. 29, 1941, set price at 7¼c a lb. for glacial of wood origin and 6¼c a lb. for synthetic, in tank cars, delivered. Producers from wood may add freight in excess of 32c per 100 lb. Revised Jan. 2, 1942, setting price at 6.93c a lb., tank cars, fob works for both wood and synthetic grades. The tank car price is applied to the weaker grades in terms of 100 percent with 28 percent in containers quoted at 3.38c a lb.

Acid Boric

Order M-7 of June 9, 1941 established full priority control which continued through August. In January, 1942 producers were requested to suspend advance of $2.00 a ton for 30 days. On Jan. 28, this advance was given sanction.

Acid, Oxalic

Price schedule No. 78, effective Feb. 2, 1942, established a ceiling price of 11¼c. a lb. for oxalic acid where sales amount to 100 lb. or more. The price is fob shipping point with freight equalization provisions. The step was taken to avert inflationary prices because of increased war demand for the product. The ceiling is what producers have charged since Oct. 1.

Alcohol, Butyl

Order M-30, effective from Aug. 28 to Nov. 30, placed butyl alcohol under full priority control and on Dec. 1 the order was extended indefinitely.

Price schedule No. 36 of Oct. 27, 1941, established price at 10¾c a lb. delivered, in tank cars and 11¾c a lb. for carlots in drums, in the eastern territory. Effective Jan. 1, 1942, price schedule No. 37 raised maximum price to 15.8c a lb. in tank cars and 16.8c a lb. for carlots in drums. Prices in western territory ½c a lb. above these figures.

Alcohol, Ethyl

Order M-30, effective from Aug. 28 to Nov. 30, 1941, brought ethyl alcohol under full priority control and preferential ratings were given defense orders. On Dec. 1 the order was extended indefinitely. Order was amended on Jan. 7, 1942 to provide restrictions on its use and to require producers to use corn or grain instead of molasses. Companion order M-54 restricted deliveries of molasses and fixed rates of consumption. Order M-30 again amended on Jan. 24, 1942 with ethyl alcohol defined as referring only to that used for industrial purposes; restrictions on receipts changed from monthly to quarterly periods; certain orders may be filled without quantity limitations; deliveries to Army and Navy, lease-

lend countries and holders on internal revenue permits exempted from quantity and certificate requirements.

Price schedule No. 28, effective Sept. 15, established maximum price of 24½c a gal. fob works for SD2B. On Oct. 23, 1941, permission granted Pennsylvania Alcohol Corp. to charge 5c a gal. premium. On Nov. 7, 1941, Publicker Commercial Alcohol Co. permitted to produce nearly 4,000,000 gal. from raw sugar and sell this prior to Dec. 31, 1941 at maximum price of 49½c a gal. in tank cars, basis SD2B. On Dec. 11, 1941, producers asked to refrain from quoting on deliveries after Jan. 1, 1942. On Dec. 20, maximum price was moved up to 50c a gal. fob works.

Alcohol, Methyl

Order M-31, effective from Aug. 28 to Nov. 30, 1941 placed methyl alcohol under full priority control and established preferential ratings for defense orders. On Nov. 12, the order was amended so that: ratings of B-4 were assigned deliveries of natural used as denaturant; same rating given synthetic for chemical manufacture; B-8 rating for anti-freeze; inventories beyond 30 days supply forbidden. On Dec. 19 order again amended to remove limits on amounts delivered for denaturing ethyl alcohol, for formaldehyde, and for general chemical manufacture. Rating for use in formaldehyde raised to B-3. Amendment on Dec. 31 forbid use for manufacture into, or packaging as, anti-freeze agent.

Borax

Order M-47 of June 9, 1941 placed borax under priority control because of shortage caused by strike at large producing plant. Order effective through August. Advance in price requested by a western producer in January 1942 was suspended for 30 days but on Jan. 28 the advance of $1.00 a ton was permitted.

Carbon Tetrachloride

Maximum prices for the sale of carbon tetrachloride in quantities from 5 gal. upward are established by price schedule No. 79 which went into effect on Feb. 2. The ceiling is set at 5¼c a lb. in zone 1 for tank cars, delivered. Carlots in 50-55 gal. drums are fixed at 73c a gal. and 5 and 10 gal. cans at $1.07 a gal. On export shipments the maximum set for the zone in which the port of shipment is located applies fob vessel plus 6.5c a gal. On overland shipments to Mexico and Canada in tank cars, the zone price apply plus .003c a lb., plus transportation charges over a standard route from seller's shipping point to destination, less transportation charges over such route from seller's shipping point to the station in the United States which is at or nearest to that point on the boundary at which the shipment crosses from the United States.

Carbon Black

Price Administrator called meeting of producers in June, 1941 to prevent proposed price advance of 12½ percent for third quarter deliveries. On Dec. 17, producers were given permission to raise prices by about 5 percent to offset higher production costs and loss of revenue from export sales. Effective Jan. 1 prices are 3.30c a lb. for ordinary, in bulk; 3.55c a lb. for compressed or dustless, in bags; and 3.625c a lb. for grades suitable for ink or paint, packed in light bags.

Cellophane

L-20 order, effective Nov. 8, 1941 forbids use of cellophane and similar products made from cellulose, for a wide range of specified lines. On Dec. 2, the Toilet Goods Association was advised that cosmetics and soap wrapped or packaged with cellophane may not be shipped after Jan. 8, 1942 without special notice.

Chlorinated Rubber

Order M-46, effective Nov. 1, 1941 provides that total production and distribution be placed in charge of the Director of Priorities. Producers may make deliveries only under direction although an exception was made in the case of Hercules Powder Co.'s October output.

Chlorinated Solvents

Order M-41 of Oct. 15, 1941 authorized placing all stocks under full priority control. Producers directed to fill defense orders first, set aside 5 percent emergency pool of each solvent or 20 percent in excess of defense requirements. Consumers with B ratings were classified. B-8 rating given dry-cleaning and other industries.

Chlorine

Order M-41, effective July 26, 1941 placed full priority control over producers of liquid and gaseous chlorine. Defense orders were given a A.10 rating and such orders must be accepted. After filling defense orders producers may fill other orders without limitation. On July 30, essential industries were specified including water purification, sewage treatment, sanitation, refrigerant gases, slime control, medicinal products, and preserving and processing food. In September pulp and paper manufacturers were directed to limit use of chlorine in bleaching rag stock to 80 percent of the amount used in the first half of 1941 and to 70 percent in semi-bleached grades. L-11 order of Nov. 15 made further cuts in chlorine for pulp and paper. Brightness ceilings were set up ranging from 4-point cut in best rag paper to elimination of use in groundwood. Bleaching also was banned for most bags, sacks, and wrapping paper. Order M-19 amended on Dec. 20 with all domestic production subject to direct allocation after Feb. 1, 1942. Regardless of priority ratings, no producer may accept orders after the 10th of any month for delivery in the next month without specific permission. All producers must file on or before the 15th of each month, a schedule of deliveries to be made the following month. A reserve of 5 percent of monthly production must be set aside. On Jan. 27 the War Production Board announced that chlorine for water purification will be provided. It also was stated that high test calcium hypochlorite and chloride of lime are more scarce than chlorine and sodium hypochlorite and suggested that plants using those materials change to one of the latter.

Diphenylamine

General Preference Order No. M-75 issued Jan. 30, 1942, to take effect immediately and continue until revoked, places diphenylamine under complete allocations control. At the beginning of each month the Director of Industry Operations will specify deliveries for the month. The order applies not only to ordinary shipments but also to intracompany transactions.

Fish Meal

Price schedule No. 73 issued Jan. 20, 1942 places temporary maximum prices for sales of fish meal. On and after Jan. 20 sales prices will carry a maximum of $66 a ton for meal of 55 percent protein this to apply in the eastern territory with Pacific Coast prices $63.50 a ton. The maximum price goes up as the protein content rises. The prices refer to shipments in new bags.

Formaldehyde

Order M-25 of Aug. 21, 1941, placed formaldehyde under full priority control. The order also included paraformaldehyde, hexamethylenetetramine, and synthetic resins made from them. The order was amended

a few days later giving defense orders a rating of A-10 or higher and these orders must be given preference. Defense orders must be accepted even though previously placed non-defense orders are delayed. In the case of the synthetic resins some non-essential uses are given no rating. On Aug. 20 price schedule No. 21 established ceilings for formaldehyde with tank cars at 4.25c a lb. fob New York, West Haverstraw, N. J., Garfield, N. J., Perth Amboy, N. J., or Tallant, Okla., freight equalized. For carlots in drums the price was set at 5.4c a lb. Effective Jan. 15, 1942, an amendment was made designed to avert hardships to certain users. It withdraws exemptions for formaldehyde to be used in embalming fluids from the maximum prices and puts all users on the same basis regardless of the use to which it is to be put.

Glycerine

Price schedule No. 38, effective Nov. 10, 1941, brought glycerine under price control at levels considerably lower than had been prevailing. The schedule established base maximum prices of 11½c a lb. for crude and 18c a lb. for refined. The order pointed out that this material had been stable in price for three years yet had risen in price 150 percent in nine months. In fixing prices, zones were set up with zone C referring to the far west and there a premium of 2c a lb. is permitted over the maximum levels. On Dec. 10 the Office of Production Management requested producers, refiners, jobbers, and dealers to ship no glycerine except for direct defense requirements, for hospital and medical use, and except to prevent an immediate shutdown in a civilian plant. Reports also were asked on stocks of 80 percent or better both by totals and by location.

Lithophone

Producers had agreed to a price of 4¼c a lb. for sales of ordinary grade lithophone but on Jan. 28 price schedule order No. 80 was issued, effective Feb. 2 which established that price as a maximum. It is stated that speculation by others than producers has increased greatly resale prices of the product. The price ceiling was set to curb speculation and to eliminate the threat of further price advances. The ceilings cover six grades.

Mercury

Order P-73 of Dec. 20, 1941 grants priority aid to producers in obtaining maintenance and operating supplies. On Dec. 27, order M-63 placed import of 13 materials, including mercury under government control. All contracts for imports will be handled by RFC and existing set up of dealers and brokers will be used. On Jan. 26 conservation order M-78 was issued to conserve supplies for war purposes. It provides that after Jan. 15 no one shall use mercury in the manufacture of any item or process on List A of the order in excess of 50 percent of his requirements during a given base period and after March 31 he will stop using mercury for such purposes. List B of the order which includes fluorescent lamps, health supplies, mercuric fulminate and thermometers are allowed to use up to 100 percent and even 125 percent of what they did in the first quarter of 1940 or 1941.

Oils and Fats

On Aug. 28, 1941 schedule while it placed no ceilings was intended to eliminate speculative and inflationary price practises. The rising price for cottonseed oil gave the most concern. On Oct. 14 the schedule was amended to allow price guarantees on unshipped balance of contracts to extend 30 days date of sale, will eliminate cancellation of shortening orders and will provide that amounts ordered be taken out within 30 days from date of order. On Oct. 18 M-40 order placed all supplies of crude and refined sperm oil under full priority. No deliveries are to be made except for defense purposes and also provides that any dealer holding in excess of 100,000 lb. of sperm oil on the effective day of the order shall set aside 30 percent of all stocks in a special pool out of which specific allocations can be made. Such dealers are required to continue to set aside 30 percent of shipments received.

On Dec. 13 price schedule 53 was issued setting ceiling prices over all fats and oils except butter. Effective immediately the schedule forbids the sale whether spot or future, raw, crude, or refined fats and oils including lard and cottonseed oil, at prices above those prevailing on Nov. 26. The ceiling applied to all stages of distribution except retail.

On Dec. 30 the OPM issued order M-71 which has for its purpose to conserve the supply and direct the distribution of oils and fats. Some 1800 different kinds of oils and fats are affected by the order which prohibits delivery of these products to manufacturers or processors in excess of a 90 days supply. On Jan. 8 tung oil was placed under strict priority control through order M-57. Coming from China, future supplies of this oil are uncertain. Arrangements are being made for Defense Supplies Corp. to purchase all existing stocks and all future imports.

Paints

Order P-65 was intended to aid manufacturers of marine paints in obtaining necessary raw materials. The order was issued on Dec. 5 and will remain in effect until revoked. To qualify for use of a preference rating, a producer must supply the Chemicals Section of the Priorities Division, on Form PD-82 information as to his volume of production, inventory and anticipated needs by three-months periods.

Paraffin

Price schedule No. 42 of Nov. 21, 1941 was issued because prices of crude scale paraffin wax had been rising sharply. The schedule provides that after Dec. 1, 1941 regardless of the terms of any contract of sale or purchase no person shall sell in quantities of 1,000 lb. or more at more than 4.25c a lb. for 122-124 amp. for crude or semi-refined nor above 5c a lb. for refined 120-122 amp.

Phenols

Order M-27 of Aug. 30 brought phenols under full priority control up to the end of the year. Defense orders were given A-10 rating with directions that such orders must be accepted. Remaining supplies are subject to allocation this including synthetic phenol, phenolic acids, pure or crude, obtained from coal-tar distillates comprising phenol, ortho cresol, meta cresol, para cresol, and xylenols. Amendment to the order in November tightened control over distribution and placed all shipments under direction of the Director of Priorities and all handlers and consumers who have more than 30 days supply on hand are directed to furnish inventory reports.

Phenyl Tri-Phosphates

Order M-16 of Aug. 20 placed distribution under priorities with A-10 rating for defense orders. Cresyl tri-phosphates were included in the order. After defense orders are filled remaining supplies may be allocated.

Phosphorus Oxychloride

Order M-35 directed that this material be under full priority control with A-10 ratings for defense order

which must be accepted and fulfilled in accordance with Priority Regulation No. 1.

Polyvinyl Chloride

Order M-10 established full prority control on Aug. 9, 1941. The order defined polyvinyl chloride as polymerized vinyl chloride and its copolymer with vinyl acetate, containing 92 percent or more of vinyl chloride including Koroseal and Vinylite. At the end of the year the order was amended so that on and after Jan. 1 no deliveries shall be made except as may be specifically directed by the Director of Priorities. At the beginning of the month he will issue to producers specific directions covering deliveries which may be made that month. The new restrictions also apply to intra-company transactions. The order was made effective indefinitely.

Potassium Perchlorate

Order M-32 of Aug. 28 gave the usual directions for priority control with defense orders given the preference.

Potassium Permanganate

Order M-33 effective Aug. 28 was similar to that for perchlorate in that it placed the material under priority and directed that defense orders be given preferential treatment.

Refrigerant Gases

In August Supplies of Freon were allocated to users and manufacturers of refrigeration and air-conditioning equipment in accordance with the relative importance of the consumers. Order M-28 was issued on Aug. 15 directing that chlorinated hydrocarbon refrigerants be placed under full priority with A-10 rating for defense orders and allocations for the remaining supply.

Shellac

On Dec. 10, 1941 the Materials Division of OPM requested importers not to ship any natural resins to anyone except on sworn statements that immediate shipments are necessary for direct defense work or that they are needed to prevent shutdowns at plants. A few days later importers and handlers of shellac and natural resins were requested not to raise prices above the levels prevailing on Dec. 5.

Sodium Nitrate

Order M-62 was issued Jan. 15 to set up a complete allocation system for distribution of sodium nitrate to take effect Feb. 1. At the beginning of each month the Director of Priorities will issue to all producers and distributors specific directions covering deliveries which may be made during such month.

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Synthetic Resins

Civilian use of synthetic resins was put on allocation basis in July with some non-essential uses banned, and others considerably reduced. On Aug. 21 order M-25 brought synthetic resins under full priority as well as the principal raw materials used in their production. In October M-25 was amended, extending through the month earlier adjustment of provisions which allow makers of molded radio cabinets to use certain synthetic resins molding powders. A rating of B-4 instead of B-8 was given for deliveries of synthetic resins for utilitarian garment buttons.

Toluol

Order M-34 of Aug. 28 directed full priority control for toluol with defense requirements getting the preference in distributing supplies. On Dec. 30 it was announced that all toluol in the country will be subject to allocation beginning Feb. 1. The order will apply to stocks on hand as well as to production after that date. After Feb. 1 at least 70 percent of the total production of all producers must be of nitration grade and deliveries of this grade are to be made only in accordance with specific instructions from the Director of Priorities. Ratings for civilian uses are B-1 for medicinals and drugs, B-2 for petroleum additives, B-3 for dyes and intermediates, B-4 for rubber accelerators, B-5 for miscellaneous organic chemicals, and B-6 for solvents. Use of toluol as a diluent for protective coatings will be entirely prohibited after Feb. 1. No toluol is to be exported without authorization.

Titanium Pigments

Order M-44 of Nov. 22, 1941 directs the distribution of titanium dioxide for use as a pigment through a monthly allocations system. The order became effective on Dec. 1 and its purpose is to set up a defense pool to take care of mandatory orders and prorate the remainder on an equitable basis. The reserve is set at 20 percent of each producers daily production of titanium dioxide for filling orders for pigments. When a producer in any one month has accepted defense orders in an amount equal to his reserved quota percent, subsequent defense orders placed with him may be returned to the one making them. The order was amended making its effective date Jan. 1. Another amendment to the order under date of Jan. 7 clarified the submission of certificates covering monthly requirements and also made allowance for seasonal users in distribution. On Jan. 28 the percentage of titanium dioxide to be set aside was increased from 20 to 25 percent.

Other Price Developments

Abrasives—Manufacturers of coated and bonded abrasive products have been asked not to sell at prices above those each manufacturer had in effect on Oct. 1 1941.

Bleaching powder—Prices were stabilized by a series of individual agreements with producers. Temporary ceilings are 25c a 100 lb. over the 1941 figure.

Dry colors—Individual agreements stabilizing prices for organic and inorganic dry colors were made last November. Ceilings were at the Oct. 1 levels. This agreement effective through December has been extended to April 1.

Fluorspar—Producers have been asked not to raise prices over those prevailing on Jan. 2, 1942. Notice one month in advance to be given in case any change is contemplated.

Lead pigments—Following higher prices for the metal, manufacturers of pigments were asked not to raise prices above the Jan. 2 figures. An immediate study will be made with a view of working out a longer-range price program. Later in Jan. price advances were authorized.

Pyrophosphate—A major producer has reduced the price for this chemical and agreed to maintain the lower price through the first quarter.

Sulphur—A leading producer has announced that no price advance would be made.

Sulphuric acid—One of the largest producers has agreed to continue prices over the first quarter.

Discussions regarding price stabilization have been held with manufacturers of asphalt, aspirin, caffeine, citric acid, vitamin C, salicyclic acid, and theobromine.

Processing Synthetic Rubber

Chem. & Met. INTERPRETATION

Since December 6, the day the Japanese commenced their attack on the Far Eastern possessions of the United States, the British and the Dutch, synthetic rubber has become of vital interest to the Victory Program. On January 12, the federal government announced a huge expansion in our infant industry. This move means not only many large plants for the production of rubber, but also numerous plants to make the raw and intermediate materials. Therefore a brief summary of the several types of synthetic rubber that will be made and their raw materials is timely.—*Editors.*

SYNTHETIC RUBBER has been made in the United States to a limited extent for a decade and during the last year several shadow plants financed by the federal government have been turning out new types; but it now appears that we are on the verge of an enormous expansion program.

The synthetic rubbers may be divided into five groups: (1) reaction product of aliphatic dihalides (Thiokol), (2) polymers of chloroprene (neoprene); (3) copolymers of butadiene with other polymerizable compounds (Perbunan, Buna S, Ameripols, Hycars, Chemigum); (4) plasticized polymers of vinyl chloride (Koroseal); (5) polymers of isobutylene (Vistanex).

While it is probably true that facilities for the production of all synthetic rubbers are being expanded, most of the new construction will be for the output of the Buna types, Buna S is made from butadiene and styrene. The former can be most readily produced in large quantities by the dehydrogenation of butane gas now available in large quantities in the oil-well regions of the Southwest, or by the high-temperature cracking of various petroleum fractions (see *Chem. & Met.*, April, 1940, pp. 220-224). An essential step in either process is the purification of the butadiene. Styrene may be made by catalytic reaction of ethylene or ethyl chloride and benzene to form ethyl benzene which is dehydrogenated under heat and pressure to yield styrene. Cracking petroleum under certain conditions yields a mixture of styrene, olefins, etc., which are then separated. It is also recovered from light oil from carburetted water gas manufacture. The rubber is produced by the emulsion technique. Ingredients are emulsified with water and subjected to conditions of temperature and pressure suitable for converting them into a suspension of synthetic rubber resembling latex from the rubber tree. Polymerization proceeds quite rapidly. Although the process requires close control, it does not present any problems that differ greatly from those ordinarily met in everyday operations. The rubber is recovered by coagulation of the emulsion with acetic acid.

Buna N is made from the raw materials, butadiene and acrylonitrile. The latter may be made by at least two methods: (1) dehydration of ethylene cyanohydrin which in turn is produced by the reaction of ethylene chlorohydrin and sodium cyanide. Ethylene chlorohydrin is made from ethylene and chlorine. (2) Direct addition of hydrogen cyanide to acetylene by means of a catalyst.

The butadiene and acrylonitrile are emulsified in water, using a soap as the agent. By applying the proper conditions of temperature and pressure a whitish viscous suspension of Buna in water is produced. An acid coagulant is added and the curd separated and dried. It resembles pale crepe.

Butyl rubber has been described as a copolymer of olefins with small amounts of diolefins. It is made entirely from petroleum products by processes more simple and direct than those required for the manufacture of Buna.

Isobutylene, the raw material for Vistanex is formed in the cracking of petroleum or natural gas, and can be recovered by relatively simple methods. When pure isobutylene is polymerized at low temperature in the presence of a catalyst such as boron trifluoride, a series of high molecular weight linear polymers is formed, according to the extent of polymerization. These polymers are chemically almost completely saturated and therefore inert to most types of deterioration. (See *Chem. & Met.* April, 1940, p. 224).

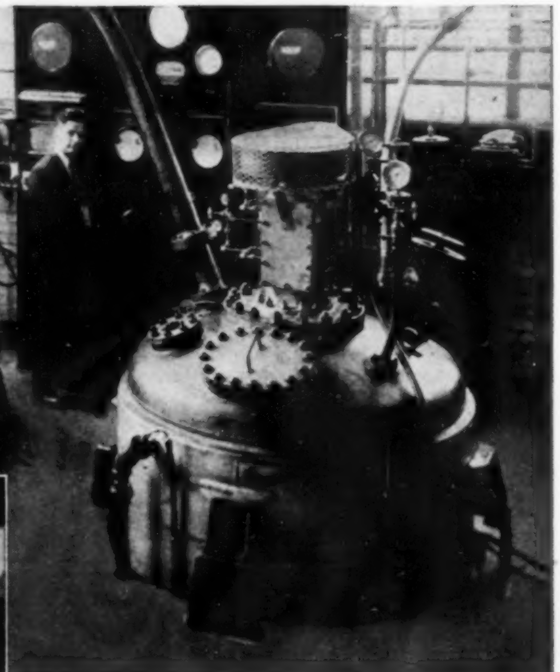
Neoprene is polymerized chloroprene. The raw material, acetylene, is produced from calcium carbide. The first step in the process of making this synthetic rubber is the conversion of acetylene by catalytic synthesis to monovinyl acetylene. By treatment with hydrogen chloride the mass is converted into chlorobutadiene or chloroprene. Chloroprene polymerizes more rapidly than butadiene and the product can be controlled by the extent to which cross linkage takes place. (See *Chem. & Met.* Nov., 1935, pp. 588-594).

The first of the synthetic rubbers in this country was Thiokol, polyalkalene sulphides. The raw materials are ethylene dichloride made from ethylene obtained by cracking natural gas, and sodium polysulphide made from sulphur and caustic soda. Ethylene dichloride, sodium polysulphide, magnesium chloride and catalysts are treated in a reactor to form latex. From the reactors the latex flows into a vessel where it is coagulated by the addition of an acid. It is then washed, flaked and dried. (See *Chem. & Met.*, April, 1938, pp. 198-199).

Plasticized polyvinyl chloride is known as Koroseal and by other trade names. The principal raw material is ethylene, which is converted to ethylene dichloride. By treating this material under pressure with alkalis vinyl chloride is formed, which is polymerized to polyvinyl chloride. This is an amorphous white powder. As such it is not rubbery but when highly plasticized, usually with tricresyl phosphate, rubber-like properties and characteristics are imparted to it.

RUBBER made in U.S.A.

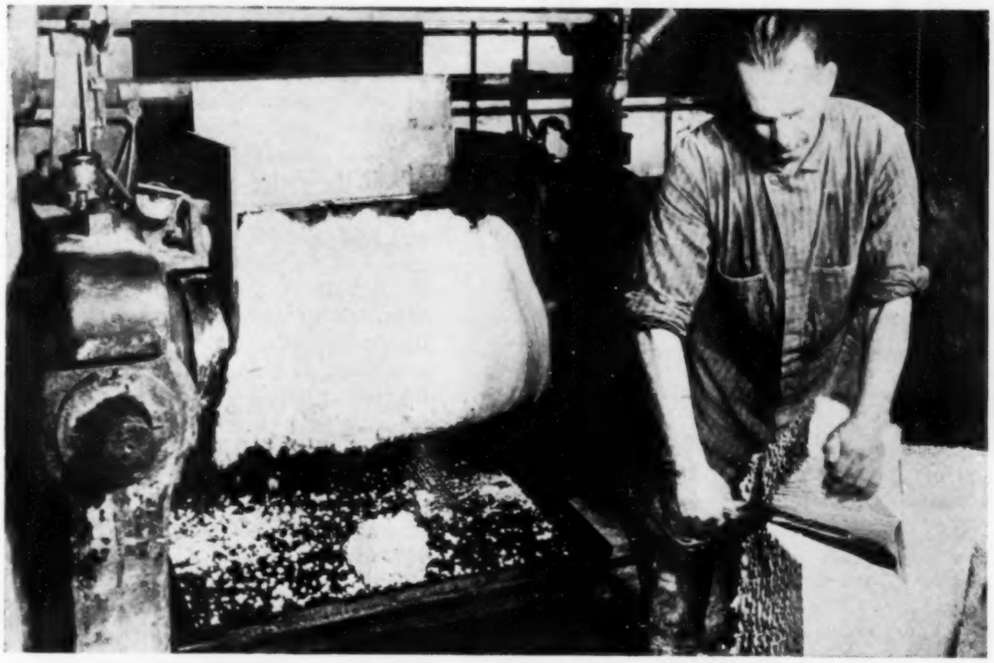
Butadiene being transferred from tank car to storage. This is the basic ingredient for the production of the synthetic rubber, Ameripol, made by Hycar Chemical Co., jointly owned by B. F. Goodrich Co. and Phillips Petroleum Co.



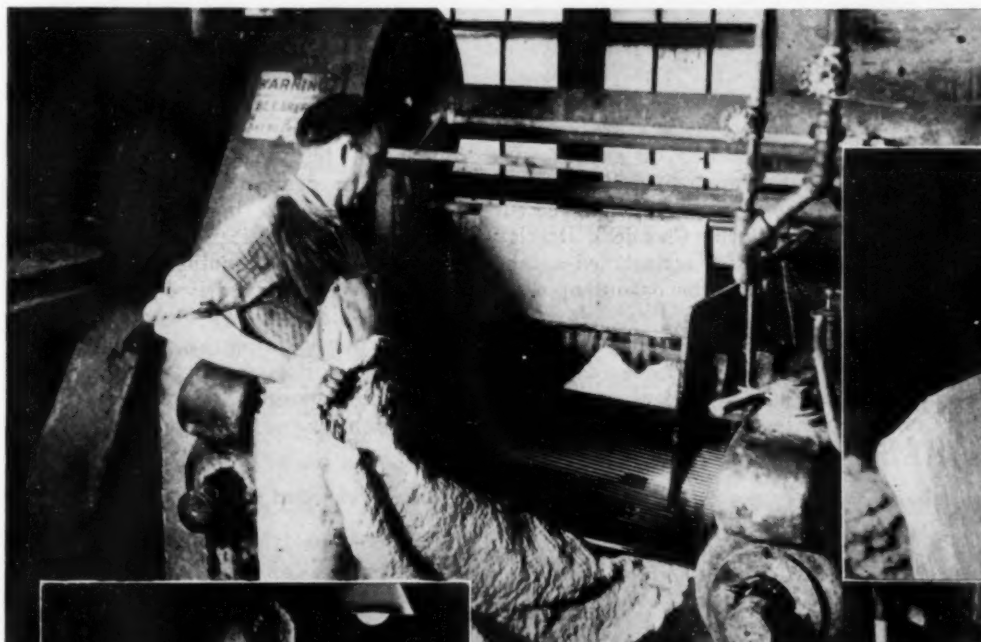
Butadiene and other ingredients which go into the production of synthetic rubber are polymerized in large steel vessels in which they are agitated and emulsified in a soap solution under pressure

Vat of a solution of raw rubber after it has been coagulated showing closeup of a strainer full of curd-like particles. Curds rise to top of the solution after the washing process

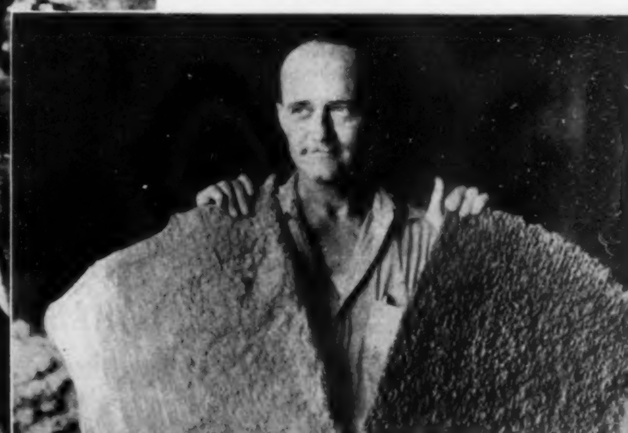
Ameripol is one of several synthetic rubber materials that is playing an important role in the war program. The butadiene and other ingredients are polymerized in large steel vessels in which they are agitated and emulsified in a soap solution under pressure. Conditions affecting the process are rigidly controlled and automatically regulated. Each polymerizer will produce about a ton of product daily. The latex is stirred in large vats in which it is stabilized. In another vat the rubber is coagulated with dilute acid. The curd is first washed by agitation in a vat. Then the curds are skimmed from the vat and placed in forms where they solidify to square blocks of raw synthetic rubber. The blocks, each weighing about 110 lb., are cut up into small pieces and sheeted on a wash mill. The rubber is calendered, extruded in tube machines, or molded in multiple forms.



Chunks of the rubber, cut from the blocks in foreground, are placed on a wash mill where moisture is extracted and it is sheeted into thin sheets



Mill man cutting a sheet of rubber so as to remove it from the wash mill



A sheet of dried synthetic rubber at left and dried natural rubber at right

Tests on this miniature laboratory mill were the basic controls in the development

In appearance the Ameripol tire is identical with that of a natural rubber casing. Side walls and tread are of the new synthetic

An American's Appraisal of Japanese Chemical Industry

Chem. & Met. INTERPRETATION

The following brief summary was prepared for *Chem. & Met.* by a well-known American chemical engineer who has spent a number of years in Japan. It is illustrated with drawings and photographs copied from a souvenir volume on the Japanese chemical industry issued by one of the largest companies in that industry.—*Editors.*

Modern chemical engineering in Japan dates from the end of the last World War. It may be only coincidence but with the acquisition of the Mandated Islands, Japan embarked on a chemical industry of large proportion. Her ambition in chemical lines is believed to exceed that of Germany or that of the United States. To support such a program Japan needs large and low cost supplies of sulphur, salt, coking coal, the metals, and oil and gas, served by a plentiful supply of electric power. The Japanese Empire of 1918 contained no such supplies and the fairly abundant supply of waterpower was undeveloped.* The last twenty years have been devoted to improving this situation—both by conquest and by purchase of plants and information from Europe and the United States. The objective of this feverish and extensive development is to control world markets in chemicals, and to build and support a military regime for further world conquests.

Within the writer's limited knowledge, the Japanese started this program with phosphates and fixed nitrogen compounds to insure and lower the cost of necessary food. Before that their diversified chemical industry was typically Japanese; confined to very small units and largely associated with the silk trade and the decoration of cheap toys; dyestuffs and pigments in other words. Most of the intermediates and semi-finished materials for this pre-war industry were purchased in Germany.

No complete figures are available for the production of any chemical products in Japan since 1938. In the U. S. Department of Commerce survey on "World Chemical Developments," in 1939, is included a tabulation covering the output of a few items by companies affiliated with various producers' associations which, on the average, are believed to represent about 70 percent of the total production. A significant point brought out by this survey is that in the five years from 1934 to 1939, tremendous increases were to be noted particularly in such basic materials as caustic soda and soda ash, calcium cyanamide and ammonium sulphate.

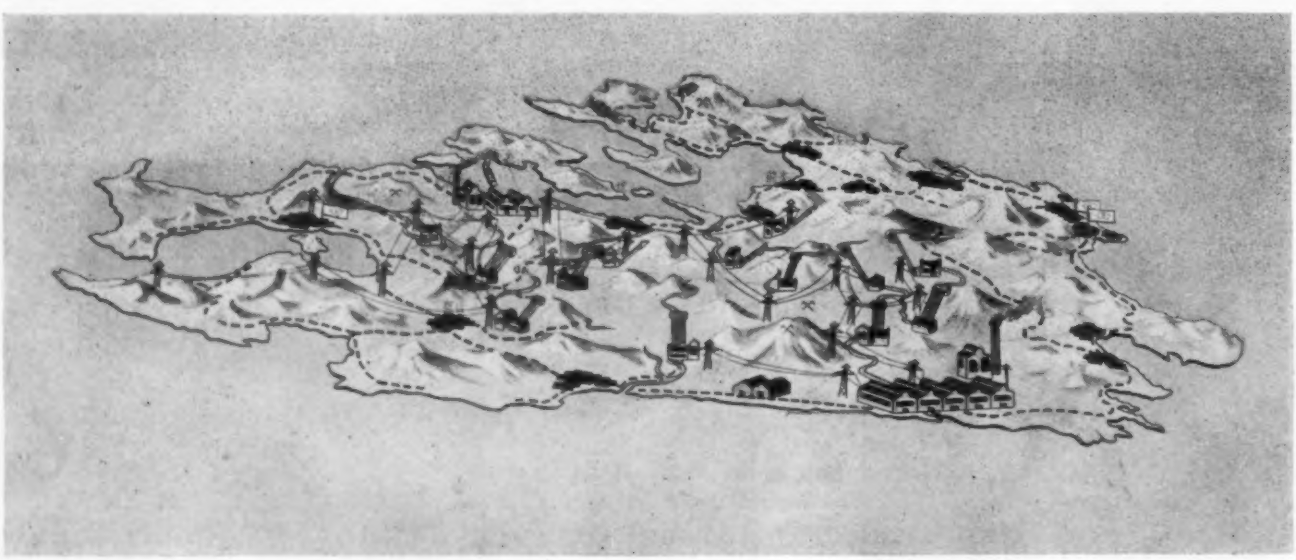
It was estimated that the total output of the entire chemical group had a value of 2,110,915,000 yen in 1936 and 3,020,915,000 yen in 1937, an increase of 43 percent. Although only about half of these totals represent chemicals proper, it is apparent that the output of chemicals experienced a substantial gain, conservatively estimated at between 20 and 25 percent for the single year 1937. Data covering production for 1936, the latest year for which official figures were then available, showed an output exceeding 1,068,442,000 yen ($310,-000,000).

With the present expansion of her chemical industry, Japan has today become a large producer of all basic chemicals. After the fertilizer compounds, which Japan developed first because of the abundance and cheapness of the raw materials: air, electric power, and water, the next big expansion occurred in acids and alkalis. Modern sulphuric, nitric and acetic acid, soda ash and synthetic ammonia plants, have been constructed by English, German and American firms. Japan, with fixed nitrogen plants built by German, Italian and American companies, has nitric acid and synthetic ammonia capacity approximately equal to that of the United States prior to our present expansion program.

As Japan conquers new territories with new resources, the raw materials are immediately converted into fin-

*See accompanying drawing of the Island of Kyushu, showing interconnected system of hydroelectric and industrial units.—Editor.

Japanese Island of Kyushu showing inter-connected system of hydroelectric units serving large chemical industries on seaboard



ished products along the lines of modern chemical practices to the end that they are utilized in very much the same way as in Germany and America. Furthermore, this is being done within a remarkably short time after the original conquest. Japan has exploited to the fullest extent the cheap Chinese labor which is now less than one-third the cost of equivalent Japanese labor.

The Japanese are clever as imitators. They have shown ability to grasp and appropriate all that is done elsewhere in the world, and to convert and apply the knowledge and experience of others to the possibilities offered in Japan.

To a certan extent there is a false economy in Japan, similar to that of any totalitarian state. For example, at certain places obsolete plants of small units with methods of production which have long since been discarded as too costly in Europe and the United States, are not only being used in Japan but are being extended by plant enlargements along the older lines. Production is more vital than economy. Labor in Japan, while more costly than a few years ago, is still far below the cost of American labor. It is not as intelligent, it is not as resourceful, and it is not as responsive to direction as American labor, but far better disciplined and controlled. Nevertheless, at the wage rates such labor commands, the general effect is a much lower labor charge per unit of product than we ever had in the United States.

The chemical industry in Japan, with the Mandated Islands and the conquered territories in China, has sufficient diversified raw materials to be a real threat, and in fact is a real threat at the present time, to the American chemical industry.

Unless drastically curbed, Japan will capture all of our foreign chemical markets on an economic basis, which if insufficient will be bolstered by a national subsidy in order to hold control of the foreign chemical industry. The Japanese chemical industry, through absolute control by four large companies who in turn are ruled by a military dictatorship, has all the earmarks of a totalitarian state.

Japan's largest nitrogen and related chemicals plant Chosen Chisso Hiryo K. K. at Konan. Note relation to sources of hydroelectric power, shipping facilities for export. This is also the site of one of Japan's largest viscose rayon plants

Photograph taken during construction of the large Japanese chemical and munitions plant shown in the accompanying drawing

Manpower in War-Time

RUSSELL S. McBRIDE *Editorial Consultant, Chemical & Metallurgical Engineering, Washington, D. C.*

Chem. & Met. INTERPRETATION

Chemical process industries, along with other industries, have a job of getting enough war-time personnel. But it has the special and extra problem of obtaining technical personnel for research, development and supervision jobs. Difficulties are increased by Selective Service, enlistment and other military factors. Our industries have a duty, without becoming a refuge for slackers, of asking deferment of certain technical workers who cannot readily be replaced. Morale can be built up by protecting personnel against assignments which could be carried out by unskilled and untrained individuals. —*Editors.*

Manpower for process industry is just as important in war-time as personnel for the Army. Washington knows this and is making plans accordingly. It is trying valiantly to assign to the Army all manpower which will be of greatest service there. But the men who are really needed in the production and research jobs behind the Army are to be kept there whenever possible.

Following the Pearl Harbor attack there was much excitement and confusion regarding personnel problems. It required several weeks of critical work on the part of officials to figure out the framework of any new plans which should be used to guide the placement of individuals. Official Washington concluded that the ideal would be to have each man registered and then assigned to a task for which he was most needed. That is still the general objective. But there are many practical variations. It is important to be acquainted with the way in which the program is working in order to secure support for each unit of industry with a minimum of interference with other equally necessary war-time activities.

SELECTIVE SERVICE

There is no striking modification of the general pre-war Selective Service program. This fact is now unequivocably stated by the highest possible authorities of Washington.

During January, Brigadier General Lewis B. Hershey authorized the accompanying statement which outlines generally the program of Selective Service. These general plans have been submitted to the President and the Cabinet and have complete approval of the highest possible authorities.

One of the greatest difficulties being experienced is that inherent in the operation of several thousand local draft boards. Each of these groups is very properly responsive to local public opinion. That is the intention of the program and of the law. The result is a variation in the application of the law from one community to another, or between one board and another in nearby areas of the same city. This leads to some criticism. But by and large it appears that the handling of the Selective Service by civilian groups conversant with local conditions is giving a better over-all result than could be had from an arbitrary dictatorial program bossed wholly from the top.

NO INDUSTRIAL DEFERMENT

Process industry will have to find ways in which to get along without most of its younger men employees. The reason for this is evident from General Hershey's statement. The Army wants these men of 20 to 27. The Army is going to have most of them when they do not have actual direct dependents. The Army is also hoping that it will get a great many young men by enlistment from the group of 18 to 20 years in age.

Officers engaged in training work are greatly disappointed that Congress did not permit the taking of these younger men through Selective Service. They argue that it takes from six months to a year to prepare any man for active field duty. They believe that most of these youngsters should have been started on their training at an earlier stage than is likely to represent average practice under the new law. It is important to know this and to realize that the employment of such young men for industry jobs is very likely to be interrupted by their induction into the service as soon as they become eligible. It is not to be expected that such young men, even though they become very efficient in industrial jobs, can be deferred when their turn for call comes.

The rules for deferment of specialists and "necessary" industrial personnel remain unchanged in broad principle. It is evident, however, that Washington is going to regard a man as merely deferred, not "exempted" as was the case before hostilities involved the United States. A deferment because of the character of the employment had come to mean in many areas almost a permanent exemption. That was not intended by the old regulations, but it was the practice. That much of the old scheme is likely to be generally modified.

ENGINEERING EMPLOYEES

The problem is slightly different for a few groups of specialists. Engineers, chemists, physicists, and those trained for industrial supervision are needed in numbers far greater than the supply available. Congress has taken special note of this fact. It has provided funds by which the Office of Education is assisting the universities and technical schools of the country in the specialized training of this class of professional workers. Last year 120,000 registrations for specialized Engineer Defense Training were so provided with government aid in about 145 colleges. That work is going on during the present fiscal year at an increased pace with largely increased registrations in all special courses. The work now includes scientists and industrial supervisors, as well as engineers. (See *Chem. & Met.* Jan. 1941, pp. 95-102.)

Despite the urgent need of these young men for industrial jobs, there has been no blanket exemption granted for them. Nor is it likely that there will be such general deferment from military service. The effort is being made, however, to see to it that these men when taken into

the military organization are assigned so far as possible to technical tasks in which their special training is important.

Many process industries are now being asked greatly to expand their production facilities or to speed up operations. Whether it is a larger plant or more shifts per week, there is a corresponding increase in need for technically trained supervisors and engineering and scientific personnel. Managers of such plants have available to them ready-made an official agency of cooperation in the development of this needed manpower with specialized training.

The means for arranging quick cooperation are described below. It is important that every chemical engineer and executive of process industry know of and when necessary utilize these facilities. There is no reason why there should be attempts to raid contemporary industry which is equally busy, so long as the manpower already available with aptitude for special training has not been utilized fully. There will probably be a quarter million registrations for this kind of short course and specialized training this year. Any industry that does not get its share of these men will probably fail to do so only because it does not take the necessary initiative.

COLLEGE COOPERATION

The most successful programs organized by the Office of Education for engineer defense training have been set up after direct conference and cooperation between engineer educators and engineer executives of industries needing the men. In many cases the personnel office of a technical establishment makes tentative selection of the wanted personnel. It then directs its prospective workers to report first for specialized training before entry into active plant, research laboratory or design department work.

Sometimes the schooling is on a nearby university campus. Sometimes the university brings its professors and needed facilities into a schoolroom established at the works itself. Sometimes the courses are full-time affairs. More often they are part-time, two to five evenings a week. Sometimes the schooling is given at assigned hours during which workers are excused from their routine duties to attend class.

In most cases the training is highly specialized with respect to some single talent which is peculiarly necessary in the trainees selected. Some courses last only a few weeks, others extend part-time for as much as six months. The purpose in all cases is to give intensive education. Refresher courses will bring back a skill for which men were once trained.

Upgrading of junior workers to fit them for more responsible positions has been another important part of many programs. Straw bosses are trained to be foremen. Detail workers are given special knowledge which enables them to take more responsibility. Routine workers are given help by class, laboratory, or special shop work to raise them to a creative level not formerly realized. Thus, the maximum value from a man's aptitude and previous experience is developed. But in every case the effort is to make a rifle shot at the target of experience for a man trained to fit a particular job. Broad general shot-gun courses merely to increase knowledge of a considerable number of workers have taken second place or have been completely ignored in most institutions cooperating in these problems.

Some of the courses have been organized definitely for single company service. Others take in large numbers

Manpower Policies

An official authorized statement on Selective Service plans by Brigadier General Lewis B. Hershey, Director of Selective Service

Most of the actual combat fighting in this war will be done by the young men of America. Modern warfare is of such a nature that it requires the greatest in physical stamina, coordination, and reflex action. Generally speaking, the fitness of men for modern combat service is in inverse ratio to their age.

Under recent legislation, more than 26 million men between the ages of 20 and 44, inclusive, are liable for military service. There are an additional 13 million men 18 and 19 years of age, and 45 to 65 years of age, who are to be registered. This gives America a total manpower of some 41 millions of men who must do the tasks that are necessary in total war for total victory.

Selective Service in total war is not going to deviate from the fundamental principles which governed its operations during the peacetime training program. Men will continue to be deferred from military service when they have dependants. Men will continue to be deferred from military service when they are "necessary men," and are difficult or impossible to replace.

However, management and industry must recognize that the man who is deferred as a necessary man is deferred temporarily and each employer has the responsibility to secure and train replacements for such deferred men who are physically fit and would otherwise be available for military service. Occupational deferments are usually for a 6-month period. When absolutely necessary, such deferment may be continued for additional 6-month periods, but only where their continuance in the present job is absolutely necessary for the maintenance of our national health, safety, and interest.

There is an adequate supply of replacements for necessary men among those who are physically unfit for military service, those who are presently deferred because they have dependents, those who are above the ages liable for military service—45 to 65—and in many cases among the women of this country.

Employers must be honest and sincere in their requests for deferments and must limit such requests to cases of men who are in fact necessary. No industry or activity, no matter how closely identified with national production for war, can ever become a refuge for those who seek to avoid their obligation to their country in its hour of need.

of men who do not know just where they will get employment. But the professor always seeks to be sure before a course starts that those who finish satisfactorily can immediately be put to work using the specialty for which they are being trained. It appears that over 90 percent of those who have completed courses during the last fiscal year were placed at once. The benefit to industry has been so generally recognized that the 1941-1942 program is more than double that of the preceding year.

COLLEGE SPEED-UP

This is likely to be a long war. Even at the end of the war there will probably be a continuing aid for technically trained persons. As a consequence there has been a recognized need for continuing the complete training of young men to graduate with a bachelor's degree in engineering. For all divisions of engineering the demand continues to exceed the supply of such well-trained graduates. The demand for mechanical engineers, chemical engineers, and those trained in aeronautical engineering is conspicuously large.

These facts have led to a careful study by educators the country over of the possibility of a speed-up program. The result has been a decision by numerous institutions to place college work in engineering on an accelerated basis. Three terms per year instead of two, four quarters instead of three, are contemplated by many of the schools.

The Office of Education and its advisory groups have worked out suggested plans which were presented for official review during January. The cost of such programs has been calculated carefully. It is recognized that the institutions will have a great additional expense for full-time operation, faculty salaries, and many other extra costs. It is noted that the young men who will go to school practically 12 months a year will have a greater expense also. Furthermore, they will not be able to have their customary summer earnings. It has been proposed that Congress allocate funds which will reimburse the institutions for the extra cost and assist the young men who cannot otherwise afford the extra expense for accelerated training.

As these programs are adopted there will be many variations of plan. The objective will, in general, be to complete in 32 to 36 months the curriculum which formerly took four years. This will be done without important curtailment of the content of the courses. Vacations will be shortened, the intervals between terms will be cut to a minimum and every device practical will be utilized to get in the maximum of effective working time for the student and faculty alike.

This speed-up program is being applied in most technical schools this spring. Quite a number of institutions will release their graduates in late April or early May instead of mid-June. Those who engage these young men for operating, research or other specialized technical purposes will thus gain one or two months of trained service as compared with the normal program.

Those institutions which adopt the three-year plan expect to accept incoming freshmen almost immediately after the spring commencement. Wherever high schools can release their graduates soon enough all four undergraduate classes will probably start in June or before what would normally be a September term. It is hoped that this will produce approximately 15,000 graduates at an earlier date this year and from 15,000 to 20,000 engineering graduates, in addition to scientists and industrial supervisors, every eight to nine months thereafter.

COLLEGE DEFERMENT

There probably will be no blanket deferments for college students beyond graduation. However it is recognized that a low level of manpower does exist in certain specialized professional fields. On Jan. 12 a memorandum was sent from General Hershey to all State Directors of the Selective Service System. In the memorandum the attention of Local Boards was invited to the necessity of seriously considering for deferment students in the fields where the shortages exist. War industries, as the memo points out, are undergoing a hitherto unknown expansion. Aeronautical, Civil, Electrical, Chemical, Mining, Metallurgical, Mechanical, and Radio Engineers; together with Physicists and Chemists are essential to insure a sufficient flow of materiel for the armed forces. Industry must look to the engineering, chemical, and physics students now in training to meet their present and future requirements.

Despite these difficulties of adjusting Selective Service to protect needed supply of specialists, there will be some positive effort made toward a common sense solution of the problem. This may even take the form of giving definite deferment to young men taking technical training who will promise at the completion of their courses to take assigned tasks of military significance. The problem is to educate the public regarding the importance of these jobs which these specialized youngsters fill.

In many cases industrial executives and engineers can render a great service to the public, as well as to their own business, by making it clear generally why specialized training is just as much needed in industry as in a uniform. If the public understands this, the local boards will become appreciative of the need for proper deferment. The job is one of education. And the education should extend to the general public as well as to those who have to make decision at some local Selective Service office.

Right now one of the major problems of Washington in steering young men into technical work comes from the glamor of the uniform. As in all past times, there is to each vigorous youngster an appeal to get into the thick of a fight and do his share directly. It is not expected that this very natural tendency of youth can be altogether eliminated. Probably it should not be. But an exaggeration of this attitude can perhaps be curbed if the importance of industrial employment and the great service value of manufacture of goods needed for war is broadly publicized.

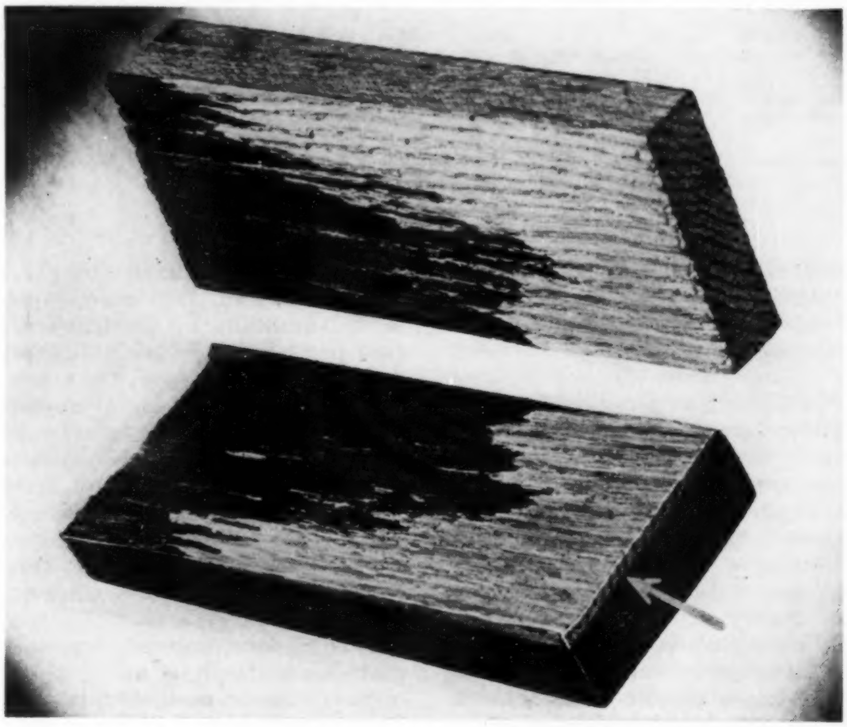
Much of the problem that Washington meets is that of youth. Much of the solution of industrial problems probably will not rest with the youngsters of the ages which the Army wants in its combat force. The employment of very many more middle-aged and older men, and the employment of many women, will be necessary.

In continuous process industry, especially in many of the more vigorous plant assignments, it may seem that these less vigorous persons are not so well suited to the tasks at hand. But in the choice of personnel as in many other factors, efficiency cannot now be the sole guide.

Engineers and executives are expected to make a conscious effort to find those who are not physically fit for the Army or who are of ages not suitable for combat service. It is hoped that groups of this sort can be given intensive training for effective employment in jobs for which normally young college men are chosen. If there are any units in chemical process industry which have thus far shirked this job, they are being urged vigorously to tackle it now.

Adhesives Industry Is Modernized

M. H. BIGELOW *Director of Technical Service, Plaskon Co., Toledo, Ohio*



Arrow points to intact urea resin glue line. Note how both blocks split across glue line

Chem. & Met. INTERPRETATION

Adoption of synthetic resins by the adhesives manufacturers has very materially affected the industry. The animal and vegetable glues are still made and used, but to them have been added several synthetic resin base products. These new adhesives offer properties not available in the earlier glues thus greatly broadening the field of application for the products of the industry.—*Editors.*

The same resins which skyrocketed plastics from cheap imitation ivory to a major industry which invades every field of human endeavor are responsible for the new adhesives. With the introduction of casein glues the field became an independent industry. Now that the chemist has joined forces with the manufacturer, the adhesives industry stands to rank with plastics as one of the principal chemical advances of the past ten or twelve years.

The earliest glues were vegetable mucilages and animal glues. While they supplied good bonds under dry conditions these invariably failed if the joints became damp. The introduction of casein and blood glues put the plywood industry on a more stable basis, since it achieved definite superiority over animal glues with respect to water resistance. While these protein glues were susceptible to fungus attack under damp conditions, bringing about subsequent delamination or breakdown of the bond, the addition of certain preservatives went a long way toward making these glues, particularly the blood adhesives, more stable than any glues which had heretofore been used. Yet plywood glued with these materials could not be considered absolutely waterproof. Soy-bean protein, blood albumen and similar glues behaved similarly.

The permanency of phenol- and urea-formaldehyde moldings, and the tackiness of intermediate condensation products of these resins led to their investigation as possible adhesives. Both resins could be made into adhesives having superior gluing properties, weather durability, and fungus resistance. There is a wide variety of resin glues, each having certain desirable or recognized properties. In Table 1 are listed the comparative properties of the several types of commercial glue. Since there is a larger variety of urea resin glues, each having different characteristics, they are covered in greater detail in Table 2. An explanation of the terms used in the tables follows.

PRESSING OPERATIONS—The introduction of resin glues, particularly the cold setting type, proved a boon to the small manufacturer of plywood products. They enabled him to manufacture resin glued plywood without the large investment in hot pressing equipment. There are three general methods of bringing about a suitable glued joint or bond.

In the case of cold assemblies joints are held in contact by strong "C" clamps. Such glues set-up at room temperature and usually have to remain in clamps over night. With resin glues the time required for setting-up can be reduced if the clamped joints are kept in a warm place, since the set-up of the glue is a function of temperatures, the higher the temperature, the faster is the action. Obviously, for thick joints, or in gluing lumber of large dimensions,

TABLE 1—COMPARISON OF PLYWOOD ADH IVES

Material	Source	Forms	Type of Pressing Operation	Ingredients Sometimes Added	Preparation for Use	Life of Mixture at 70° F.	Sprea and Handlin Equipme	Spread Lb./1000 Sq. Ft. Dry Basis—Single Surface Coated	Assembly Period in Minutes	Pressing Conditions	
										Temp. °F.	Time-hr.
Animal glue	Hides and bones	Powder, flakes	Cold press	Water and preservatives	Soak in water over-night	Extended if preserved	Heater an ller spreade	25–33	Immediate assembly necessary	Room	4–18
Vegetable adhesives—Starch	Plant carbo-hydrates	Flour	Cold press	Water and alkalis	Usually mixed hot	Severa days	Roller spreader	20–33	10–40	Room	4–18
Blood albumen	Dried beef, blood	Powder, flakes	Cold and hot press	Water, alkalis, paraformaldehyde, etc.	Mix cold	2 hr. to several days	Roller spreader	15–33	10–40	180–250	
Soybean and vegetable protein	Soybean meal, peanut and cottonseed meal	Flour	Mainly hot—some cold	Water, silicate of soda, etc.	Mix cold	Several hr. for cold press	Roller spreader	25–37	10–40	Room temp. for cold press	2–5
Casein	Milk	Powder	Mainly cold—some hot	Alkalis, formalde-hyde, etc.	Mix cold	2 hr. to 2 days	Roller spreader	15–33	10–40	Room temp. for cold press. 180–250 for hot press	
Urea-formaldehyde resin	Urea and formaldehyde	Liquids, powder	Hot and cold	Water accelera-tors extenders	Mix with water accelera-tor & extend-ers, if used	Several hr.	Rubber roll spreader	12–27	10 to several days	Room temp. for cold press. 210–240 for hot press	
Phenol-formaldehyde resin	Phenol and formaldehyde	Liquids, powder, dry films	Hot and cold	Water, alcohol, etc.	Powder is dis-solved in alcohol. Film is used as is	Several hr. Extended for films	Rubber roller spreader. Film requires table and cutter bar	15–30 film 12–25 h.p. liq. 25–40 cold pres	10 to several mo.	280–340	

particularly in thickness, heat reaches the glue so slowly that cold setting glues are a prime requisite, and it was for such purposes that they were developed.

Flat work, such as plywood, can be pressed between cawls placed between the platens of large presses. Obviously, heat can be used to advantage to bring about a rapid set-up of the bond. The thicker the panels, the longer is the pressing operation. Each glue manufacturer publishes data regarding the set-up rate of his glues.

Curved pieces were formerly made with difficulty, requiring steaming operations. However, the urea resin glues which set-up rapidly at 212-230 deg. F., have made possible a new method in which an autoclave is employed as a pressure chamber, with hot water and compressed air as temperature and pressure exchange media. Variations of this process are used in the production of plastic-wood airplanes. Timm, Duramold and Vidal employ operations based on variations of this idea.

INGREDIENTS SOMETIMES ADDED TO MIX—Some glues are merely mixed with water and applied directly to the members to be bonded. Most glues can be compounded with other materials either to cheapen the mixture, facilitate the ease of handling, or to improve the quality of the bond. Most of the resin glues require the addition of hardeners or catalysts. Without these they would not set-up to form waterproof bonds. Such adhesives are known as two part glues. Urea resin glues are available with the hardener already added and require only mixing with water. They are known as one part glues. These two part and one part resins are identical in quality; however, the choice of either one is dictated by the quantities of glue to be used. If the glue is used in small quantities, the "ready mixed" (one part) is the simpler. If, however, large batches are used, it is desirable to employ the two part glue as the resin can be mixed and the hardener added to small batches which are drawn off as needed. The resin without the hardener has a working life of several days. After the hardener has been added it is reduced to a few hours, depending on the temperature.

Some manufacturers who use two part resin glues prefer to add a dye to the hardener so that visual inspection will show if through carelessness in mixing the hardener was not incorporated.

Unextended resin glue bonds are more expensive than the earlier animal and vegetable types. Resin glues, ureas in particular, may be extended with inexpensive materials such as

TABLE 2—UREA RESIN ADHESIVES

	Preparation For Use	Life of Mixture at 70° F.	Spread Lb./1000 Sq. Ft., Dry Basis	Assembly Period in Minutes	Pressing Conditions			Conditioning of Veneers Before Pressing	Shear Strengths		
					Temperature	Pressure Lb./Sq. In.	Time		Dry Bond	48-Hr. Soak	Forest Prod. Cycle
Cold press—2 part—Regular	Mix with water. Add catalyst	5 hr.	18–27	15	Room temp. 70° F.	100–300 plywood 50–75 joints	2–12 hr. depending upon temp.	Generally unnecessary. Over 15% moisture not recommended	Good	Good	Good
Extended—50 parts flour per 100 dry glue	Add extra water and extender	5 hr.	19–30	15	Room temp. 70° F.	Same as above		Same as above	Good	Good	Poor
Ready mixed—1 part	Mix with water	5 hr.	18–27	15	Room temp. 70° F.	Same as above	Same as above	Same as above	Good	Good	Good
Hot press—2 part—regular	Mix with water, add catalyst	24 hr. low	16–25	To 48 hr.	220-240	100–300	4 min.—1/8 in. panels (varies with thickness) 1 min. per each additional 1/8 in.	Same as above	Good	Good	Good
Extended—150 parts flour per 100 dry glue	Add extra water and extender	18 hr.	18–33	30	220–240	100–300		Same as above	Good	Good	Poor
Special low fusible—2 part	Add water and catalyst	4 hr.	12-16	To 1½ days at 90°. Several at 70° C.	212–230	30–125	Varies with thickness of panels. 20 min. for 1/4 in. thickness	Same as above	Good	Good	Good
Liquid—hot press—2 part	Add catalyst	5 hr.	16–25	15	230–260	150–300	Varies with thickness of panels. 3–6 min. for 1/8 in. core at 230	Same as above	Good	Good	Good
Extended—150 parts flour	Add extra water and extender	5 hr.	18–35	15	230–260	150–300		Same as above	Good	Good	Poor

TALBI 1—COMPARISON OF PLYWOOD ADHESIVES

Conditioning of Veneers		Shear-Strength											
Moisture Content Before Pressing	After Pressing	Dry Bond	48 Hr. Soak	Forest Prods. Cycle	Fungus Resistance	Staining	Interference With Other Bonds	Exterior Durability	Effect on Tolls	Effect on Veneer of Catalyst or Gluing Temperature	Extensibility	Relative Costs	Material
3–8%	Unnecessary for hotpress, necessary for cold press. Dry to 7% for indoors, 12% for outdoors	High	Poor	Poor	[illegible]	Low	None	Poor	Little	None	None	High	Animal glue
3–8%	Same as above	Medium	Poor	Poor	Poor	Marked	Marked	Poor	Little	Varies	Sometimes added to urea glues	Low	Vegetable adhesive—Starch
3–8%	Same as above	High	Medium	Medium	Poor	Low to high	Marked	Fair to good	Little	Varies	Sometimes added to urea glues	Medium to high	Blood albumen
3–8%	Same as above	Medium	Fair	Frir	Poor	Marked	Marked	Poor to fair	Moderate	Varies	Sometimes added to siliciate of soda	Low	Soybean and vegetable protein
3–8%	Same as above	High	Poor to medium	Poor to medium	Poor. Fair if preservatives are used	Marked	Marked	Poor to fair	Marked	Varies	None	Medium to high	Casein
5–15%	None	High	High	High	Unaffected	None	None	Good to excellent	Moderate	None	Wide range of extenders	Low to high	Urea-formaldehyde resin
8–12%		High	High	High	Unaffected	Medium to high	Marked	Excellent	Moderate to high	Varies. High temperatures effect wood	Protein extenders may be used	High	Phenol-formaldehyde resin

flour, dextrose and dried blood, bringing them into line from an economic point of view. The fact that urea resins can be extended with these materials is a particularly attractive feature because it permits a relatively high quality glue at little additional cost as compared to vegetable glues. Furthermore, it is possible, by use of these extenders, to devise the proper glue formula for a specific job.

PREPARATION FOR USE — Glues are messy materials to handle. The old animal glue pot has given way to electric mixers for the resin adhesives which can be kept spic and span with a normal amount of attention. Resin glues will gal on standing and the mixer operator soon learns not to let his mixture stand too long. Obviously, the least messy glue is the film form phenolic product. Such a glue is merely a thin film of paper impregnated with phenolic resin. Its use is limited to flat or relatively flat press work and for hot pressing. In using film glue it is essential that the surfaces of the wood to be bonded are relatively smooth. Furthermore, it is necessary to adjust carefully the moisture content of the veneers before the gluing operation. Most of the other resin glues are supplied in fine powder which readily mix with water, and can be used immediately.

LIFE OF MIXTURE—Resin glues are partially polymerized products which, when completely polymerized set-up to hard infusible water insoluble products. The bonding operation consists of bringing about this completely polymerized stage. Catalysts create the necessary condition, but the rate of polymerization or set-up is a function of temperature. A urea glue which will set-up to a gal in five hours at 70 deg. F. becomes useless in two hours at 90 deg. F. Obviously, the working life of a glue mixture is dependent upon the temperature of the mixture. By keeping the glue pot cooled with water, the working life of a resin glue can be extended appreciably. Animal and vegetable glues have a long liquid or working life provided they contain preservatives, otherwise they develop objectionable fungus growths.

SPREADING AND HANDLING EQUIPMENT—In using glues, particularly the resin adhesives, it is essential to spread the proper amount on the veneer. Too much glue is wasteful and may result in a weak bond. To bring about the proper spread, rubber roll spreaders are employed. Such equipment can be adjusted to handle veneers of various thicknesses, and the degree of spread can be controlled closely. Film glues require a lay-up table equipped with a cutter bar or cutting machine.

Fungus Resistance	Staining	Interference with Other Bonds	Exterior Durability	Effect on Tools	Effect on Veneer of Catalyst or Gluing Temperature	Remarks
Unaffected	None	None	Good	Moderate	None	The only satisfactory cold press glue for waterproof bonds. Used for furniture, station wagon assembly, airplane assembly, when construction is too thick for hot pressing.
Unaffected	None	None	Fair	Moderate	None	
Unaffected	None	None	Fair	Moderate	None	Generally sold for home use where a 2-part glue is unhandy.
Unaffected	None	None	Fair	Moderate	None	
Fair	None	None	Poor	Moderate	None	Used for making waterproof plywood, scarfed joints, containers, barrels.
Unaffected	None	None	Poor	Moderate	None	Especially developed for manufacture of formed plywood for manufacture of airplanes, rafts, boats, chemical equipment.
Unaffected	None	None	Poor	Moderate	None	
Fair	None	None	Poor	Moderate	None	Used for making waterproof plywood.

SPREAD—LB/1,000 SQ. FT. As a rule veneers used for cores are spread with glue on both sides and in the case of cold glues these are assembled while the glue is still wet. With some hot press glues the surface may dry since in assembly under pressure and temperature the glue fuses for a short period of time.

ASSEMBLY PERIOD—After the veneers have been spread, they must be assembled within a definite period of time dependent upon humidity and temperature of the assembly room. Because the hardener is already in the glue, the film proceeds to set-up and pressure must be ap-

plied before the action has gone too far. Certain urea and phenolic glues have extended assembly periods. This is especially true of the urea glue for formed plywood, and for film glue which requires heat to bring about the reaction.

PRESSING CONDITIONS—These may be varied over a wide range. In some cases a long cure at a low temperature can be used, while in other instances a short period at high temperatures is desired. It is preferable to obtain as short a cure as possible at low temperature. Wood must contain a certain amount of moisture in order to be in good condition. If it is heated too high, not only is the water driven out but there may be a subsequent deterioration. Urea resin glues have an advantage over phenolics which for the most part require higher temperatures, sometimes well above the decomposition temperature of wood. With the phenolics it is usually necessary to condition the plywood after pressing to replace the moisture lost during the operation.

CONDITIONING OF VENEERS—In the case of most glues it is essential that the moisture content of the veneer be controlled, otherwise an inferior bond may result. In dealing with phenolics, poor bonds are apt to result if the water content drops below 6 percent. Urea glues are less sensitive to the moisture content of the wood and require no special conditioning.

SHEAR STRENGTH—Obviously, the major premise of a good glue is that it shall bring about a permanently strong bond. Tests for shear strength are made under several conditions. To adequately judge a bond it is essential to consider not only the shear strength in pounds per square inch, but also another factor, namely, wood failure. Unfortunately, it is difficult to evaluate wood failure in some instances and it requires a certain amount of experience.

Now that plywood is used indoors and outdoors, as well as for boats, life rafts and airplanes, it is necessary to determine the quality through tests which give due consideration to both wet and dry conditions. Therefore, glue bonds are examined by soaking test strips in water at room temperature for 48 hours, and testing while wet. The Forest Products Laboratory has developed a test which more nearly approximates outdoor conditions. It consists in alternately soaking and drying out the sample. After a definite number of cycles the shear strength is determined. Only satisfactory glues pass this rigid test.

INTERFERENCE WITH OTHER BONDS—With the development of the several types of resin adhesives, each requiring specific curing catalysts, complications were bound to arise. Casein glues are alkaline, ureas require acidic conditions, while most phenolics set-up in the alkaline region. In gluing thin veneers it is essential that the glue does not bleed through, bringing to the surface a condition unfavorable to the use of other glues.

TOOLS—Some glues have a pronounced effect on the knives used in trimming operations.

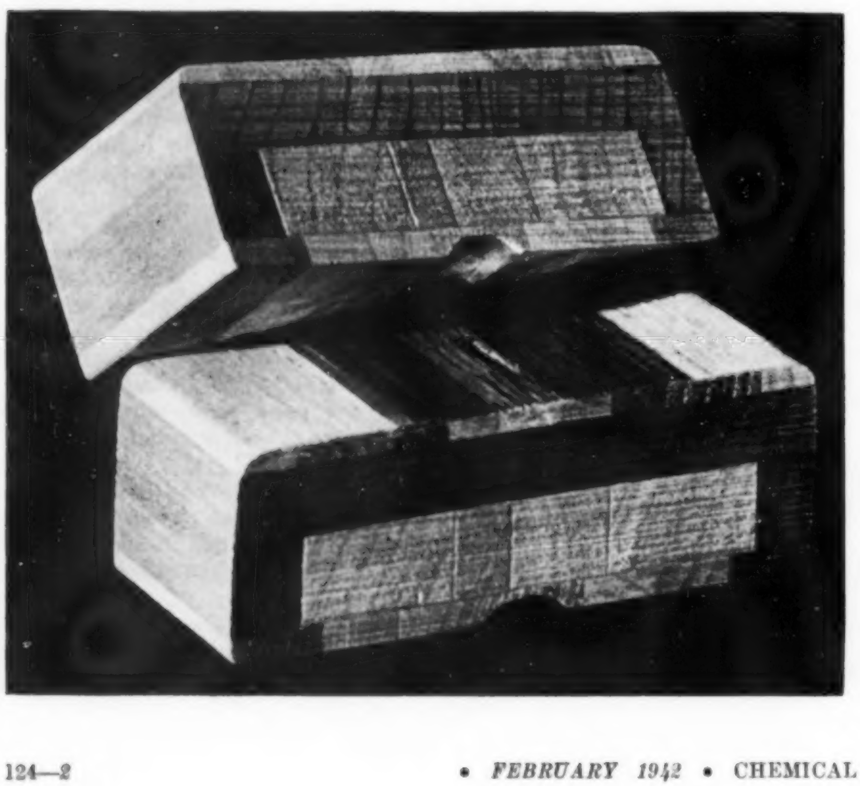
EXTENSIBILITY — Adhesives, when used straight, cost in proportion to the amount necessary to obtain a good bond and the relative cost per pound of the dry glue. If the glue is expensive but can be extended with a cheaper material without unduly effecting the quality of the bond, significant cost reduction can be made. Urea resin glue can be extended with a variety of materials, the best and cheapest of which is wheat flour. As much as 50 parts of flour can be added per 100 parts of cold press type of dry glue. Extensions beyond this amount will reduce the waterproofness and strength of bond.

Remarks—Resin bonded plywoods and resin bonded assemblies are recognized as superior, durable building materials. At this time the bulk of such materials is going into national defense use, and compliance with the General Preference Order M-25 of the Office of Production Management leaves little, if any, for civilian use. When affairs return to normal there will be a time-tested, inexpensive material for building purposes. Prefabricated houses of inexpensive construction, but absolutely durable, will be made available.

At the present time, resin bonded materials are being subjected to conditions they never will be expected to meet in normal service. Plywood life rafts, urea glued, must and are standing up in actual service in warm and cold salt water for long periods of immersion. Even worse they must withstand the baking temperatures of noonday sun and on hot steel decks in the presence of high humidities. Plywood airplanes must keep flying in temperatures ranging from 150 deg. F. to −50 deg. F.

The resin adhesives have been discussed only with respect to their bonding characteristics with wood, but it must not be construed that they are thus limited. New uses are being found every day. Canvas, cloth and textiles develop new properties when bonded with these adhesives and scores of uses are being found for such materials in national defense.

Cross section of ski laminated permanently together with synthetic resin adhesive.



Liquefied Petroleum Gas In 1941

Chem. & Met. INTERPRETATION

With an estimated marketed production increase of 42 percent, the liquefied petroleum gas industry has just completed another year of progress. The data herein was supplied by Mr. G. G. Oberfell, vice president of the Phillips Petroleum Co., who has indicated problems of the industry in 1941 and the probable trend in 1942.—*Editors.*

THE YEAR 1941 was unusual for the liquefied petroleum gas industry. New highs in marketed production for all types of uses were reached in spite of difficulty in obtaining materials for new installations, curtailment of sales activities in many quarters because of inability to secure customer equipment and restrictions on appliance financing. It was a year which saw a great increase in the industrial uses of liquefied gases in defense work and an increase in the amounts of certain associated hydrocarbons used in the manufacture of synthetic rubber and plastics.

Estimated domestic use of liquefied petroleum gas in 1941 amounts to 221,880,000 gal., an increase of 65.5 percent over 1940 when 134,018,000 gal. were so consumed. On the basis of the most reliable information available, the number of new domestic users of liquefied petroleum gas increased approximately 520,000 during the year. It is now estimated that there are a total of 1,645,000 users of liquefied petroleum gas in the domestic and small commercial classification.

Total sales volumes as shown in Table I include all liquefied petroleum gas (propane, butane, butane-propane mixtures, and pentane) when sold as such. It includes sale of pentane for any purpose other than motor fuel blending. It does not include butane when blended with heavier petroleum fractions for motor-fuel purposes nor does it include sales of hydrocarbon gases delivered by pipe line in the gaseous state to chemical concerns located adjacent to the points of production of the hydrocarbon gases; however, such sales for chemical manufacturing purposes are included if the liquefied petroleum gases are transported by tank car or tank truck in liquid form. Purchases of liquefied petroleum gases by one company from another and then resold as liquefied petroleum gas have been eliminated in order to avoid duplication of sales figures. Table I does not reflect those quantities of liquefied petroleum gas used by producers for such purposes as fuel, solvents, dewaxing, and for gasoline manufacturing purposes.

Liquefied petroleum gas is used to supplement oil-gas for standby and peak load control. Over 200 cities are now employing or arranging to use undiluted butane or propane, propane-air, butane-air, propane, butane, or mixtures for the sole source of gas or for standby, peak load control, or enrichment.

In the chemical field, liquefied petroleum gases become an increasingly important source of raw material. Volume shipments of special grades of propane, normal butane, isobutane, and butadiene were made for use in the manufacture of nitroparaffins, plastics, and synthetic rubber. For experimental and pilot plant operations such special hydrocarbons as propylene, butylene, isobutylene, and others are now available in technical grades.

New uses began to require appreciable volumes of hydrocarbons in the liquefied gas range. Among these were butadiene and isoheptene for manufacturing synthetic rubber, diolefins for plastics, propane for nitroparaffins, and normal butane for conversion into isobutane in the manufacture of aviation gasoline by isomerization and alkylation catalytic processes.

As the year ended, the industry found itself in a difficult position from the standpoint of obtaining equipment with which to make new customer installations. Several marketers of domestic systems have placed their dealers on an allocation basis, allowing them only a certain percentage of 1940 system and appliance sales.

Production facilities continue to expand at both refineries and natural gasoline plants, with the major output of the latter flowing into motor or aviation fuel channels as raw material for blending, polymerization, alkylation and isomerization.

One trend in refining technology relating to the manufacture of aviation gasoline which will have a pronounced effect on the available supply of butanes to the liquefied petroleum gas industry is the process of isomerization of normal butane into isobutane, with the isobutane then being converted into aviation gasoline by either the thermal or catalytic alkylation processes. The demands for tremendous quantities of aviation gasoline has greatly stimulated the installation of new large capacity isomerization and alkylation plants, and plans for further expansion along these lines throughout the petroleum industry are well under way.

It is still too early to estimate the volume of normal and isobutane to be required for the manufacture of aviation gasoline. However, it is reasonable to assume that large quantities heretofore available to the liquefied petroleum gas industry will soon go into aviation gasoline. Consequently, those marketers who have had a policy of marketing propane or furnishing storage and utilization equipment suitable for the use of propane are in a preferred position.

Table I—Marketed Production of Liquefied Petroleum Gas

	Total Sales		Distribution—Gallons Per Year					
Year	Gallons Per Year	Percent Increase Over Previous Year	Domestic	Percent Increase Over Previous Year	Industrial and Miscellaneous	Percent Increase Over Previous Year	Gas Manufacturing	Percent Increase Over Previous Year
1931	28,769,576	59.7	15,294,648	29.6	7,171,686	226.0	6,303,242	57.6
1932	34,114,767	18.6	16,244,103	6.2	8,167,194	13.9	9,703,470	53.9
1933	39,931,008	14.1	16,625,588	2.3	13,987,095	71.3	8,318,325	14.3
1934	56,427,000	44.9	17,681,000	6.3	32,448,000	132.0	6,298,000	24.3
1935	76,855,000	36.2	21,380,000	20.9	47,894,000	47.6	7,581,000	20.4
1936	106,652,000	38.8	30,014,000	40.4	67,267,000	40.5	9,371,000	23.6
1937	141,400,000	32.7	40,823,000	36.0	89,402,000	32.9	11,175,000	19.3
1938	165,201,000	16.7	57,832,000	41.7	94,983,000	6.2	12,386,000	9.8
1939	223,580,000	35.3	87,530,000	51.3	120,615,000	27.0	15,435,000	24.6
1940	313,456,000	40.2	134,018,000	53.1	159,153,000	32.0	20,285,000	31.4
1941	445,000,000	42.0	221,880,000	65.5	193,456,000	21.4	29,644,000	46.1

Practical Corrosion Tester for Chemical

MARTIN H. HEEREN *Chairman, Chemical Engineering Section, Armour Research Foundation, Chicago*

Chem. & Met. INTERPRETATION

The author has developed a corrosion measuring machine that goes far toward duplicating plant-scale operating conditions. It was designed primarily to determine the collective effects of heat, oxidation, galvanic corrosion and other factors on metals, but it also has been used advantageously on non-metals. This machine should be invaluable to the chemical engineer attempting to determine the most satisfactory material from which to construct a piece of equipment—*Editors.*

In the numerous industrial research investigations involving corrosion problems at the Armour Research Foundation it has been made clear that any such study must take into account the true conditions under which the corrosion may occur in the field. Corrosion investigations nearly always involve laboratory tests, and it is feared that more often than not the tests fail to yield a true index of material performance. Because corrosion is not a simple phenomenon, any simple general test of it should be looked upon with extreme suspicion.

The literature on corrosion is extensive, both in theory and practical application; however, the engineer attempting to determine just what will happen to a given piece of equipment or installation under certain conditions, finds himself confronted with the considerable task of deciding which available tests and data, if any, are applicable to his problem. In case no applicable data can be found, there remains as the only alternative a corrosion test, preferably an accelerated one. Here again, the engineer must decide which test is best suited to give him the answer to his problem.

Fig. 2—Diagram of corrosion machine

Let us for a moment consider a specific case. An engineer is commissioned to design and construct an out-of-doors installation handling a corrosive liquid in pipes and spraying the liquid in such a way that contact between the liquid and portions of the structure is unavoidable. Naturally the engineer anticipates corrosion troubles, and promptly begins a search for preventative or corrective measures. Many tests are available to him, most of them of special application. He may subject his structural material to a standard salt spray test, but since there may not be salt-water-carrying air within a thousand miles of the structure he is to build, it will not tell him what he wants to know. Again, he may utilize an accelerated oxidation test but this will completely ignore galvanic action produced by contact of dissimilar metals in the presence of an electrolyte. In short, while he is able to apply certain tests more or less simulating some of the conditions under which his installation is to be operated, upon completion of such tests he still lacks the information he wants, and that is: What, in this particular case, will be the result of the collective action of:

Heat (both in pipes and outside)
Galvanic corrosion
Concentration cell corrosion
Intermittent wetting (rain)
Oxidation (atmospheric)
Corrosive effects of the liquid

Most engineers are well acquainted with the picture of the guests sitting at the corrosion banquet, each one taking his particular share of metal. Those who may have forgotten for the moment need only to recall a few fundamental rules, given below, for our present purpose.

1. Temperature

a. Corrosion reactions are accelerated with increased temperature, as are chemical reactions in general.

b. An increase in temperature can result in increased ionization and rates of diffusion.

c. Local differences in temperature may set up electrolytic cells acting as concentration cells (1)

2. Moisture

a. Serious damage by corrosion to metal parts commonly takes place only if the metal surface is moist (2)

3. Galvanic action

a. When two dissimilar metals are coupled and placed into an electrolyte, corrosion takes place.

b. When metal is placed into a solution in which the solute is stratified in different concentrations, corrosion of the metal takes place.

A consideration of the above factors must illustrate not only the complexity of corrosion causes, but also the futility of a practical prediction of what will happen to equipment under given conditions, unless similar conditions can be produced in the course of a test. In order to accomplish this, in a great variety of applications the apparatus shown photographically in Fig. 1 and diagrammatically in Fig. 2 is often used in the Armour Research Foundation laboratories. The endless chain indicated by the dotted line is equipped with hooks from which test specimens are suspended. Rotating in a clockwise direction, 85 minutes are required for a specimen to reach its original starting point.

The flexibility of such an apparatus is apparent. Water or the particular type of liquid in which the engineer is interested, is placed into the immersion tanks (A) and (C). The radiant heat chamber (D) may be operated at different temperatures, or

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Engineers

not at all. At point (E), the sprays may be used with water or the liquid in question, or not at all. In addition the fan at point (B) may be operated to subject the specimens at points (B) and (F) to a continuous fresh supply of air (oxygen).

There are, of course, many cases for which this apparatus is inadequate. Its variability, however, answers a large portion of the ordinary laboratory demands, and its agreement with actual field results is most gratifying. While the unit was designed primarily to determine the collective effects of corrosive conditions upon metals, it has also been used advantageously in weathering tests on non-metals, such as paint, plastics, etc. In the case of paints, the radiant heat chamber (D) should be equipped with a source of ultraviolet light.

The selection of specimens for test naturally is governed by the types of materials to be employed in the construction of a plant or piece of equipment. In much of the current work at the Research Foundation, steel, cast iron, brass, copper and aluminum are used. The specimen strips, approximately ½ in. x 3 in. used both individually and coupled dissimilarly, are suspended from the chain shown in both illustrations, by means of glass hooks.

Preparation of the specimens consisted of careful cleaning by means of emery paper, followed by washing in alcohol and ether and weighing. The duration of a test is generally 336 hr. (two weeks) continuous operation. Upon completion of the test the specimens are rinsed in distilled water, alcohol and ether, and reweighed.

Let us now return to the specific corrosion problems raised earlier. Assuming the liquid to be a 30 percent calcium chloride brine, naturally the immersion tanks are to be filled with brine. Since the brine is to be sprayed at 120 deg. F., the radiant heat chamber (D) is to be maintained at a temperature of 120 deg. F. Being erected out-of-doors the structure is exposed to intermittent wetting by rain, and in part by continuous spraying of the brine; hence the sprays should be operated with water. The action of wind must be considered, consequently the fan at point (B) must be operated. Since

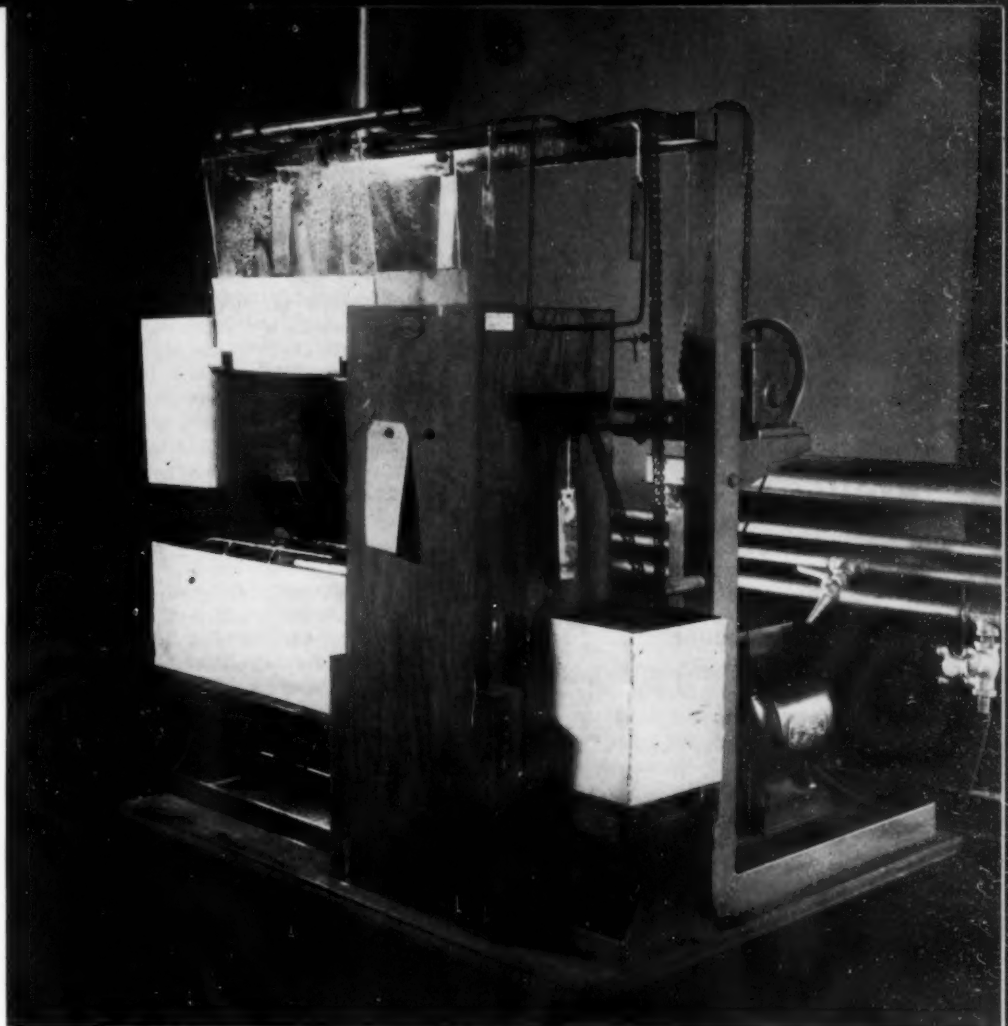

Fig. 1—A machine that measures the collective effect of heat, oxidation, galvanic corrosion and other factors on materials

the structure is held together by welds, rivets and bolts, dissimilar metal couples should be used for the specimens in addition to the individual metal strips. Cast iron, steel and aluminum are the metals which probably will be employed for construction.

In a case of this kind, after operating the apparatus under the above conditions for a period of 336 hr., the results shown in Table I were obtained.

Table I—Weight Changes in Test Strips

Metal		Corrosion mg. wt. change	Corrosion mg. per sq. in.
Single strips	steel	13.90	4.48
	aluminum .	18.90	4.80
	cast iron..	50.20	11.45
Coupled	steel	27.5	8.87
	aluminum .	230.0	63.40
Coupled	cast iron..	29.1	6.00
	aluminum .	228.0	63.30
Coupled	steel	56.0	18.05
	cast iron..	15.8	3.27

The above values express the actual weight change in each test strip, but they do not show the actual depth of corrosion, i.e., penetration. To obtain the latter it is necessary to divide the weight change in each case by the specific gravity of the corresponding metal. In Table II are given the values for the depth of corrosion calculated in this manner.

Table II—Corrosion Depth

Metal		Relative Thickness Corroded
Single strips	steel	.57
	aluminum	1.78
	cast iron......	1.58
Coupled	steel	1.13
	aluminum	23.50
Coupled	cast iron......	.83
	aluminum	23.40
Coupled	steel	2.31
	cast iron......	.45

Examination of the data in Table II tells us at once that aluminum is not the metal to be used in our hypothetical structure. The quotient $\frac{23.50}{1.13}$ = 21.7, meaning for example that a ⅛ in. sheet of aluminum will be destroyed 21.7 times as fast as the same thickness of steel. It further tells us that cast iron should be used as extensively as possible, with steel serving as second choice.

The above illustration serves to indicate the possibilities of the apparatus. Simple in construction it permits establishing certain field conditions in the laboratory, thus aiding the engineer in his choice of materials and prediction of corrosion rates.

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CHEM & MET

PROCESS EQUIPMENT NEWS

Machinery, Materials and Products

Liquid Splitter

AMONG several new developments announced by Fischer & Porter Co., Hatboro, Pa., is a new liquid splitter known as the Rotaweir which has been designed for use in continuous distillation units for automatically and accurately splitting the flow from the condensers into any desired proportions of reflux and product streams. Liquid from the condenser rises through a bottom inlet pipe into a cylindrical vessel made either of glass or of metal. After passing through a removable strainer, it rises around two weir stacks each consisting of a vertically slotted fixed-position inner tube and a similarly slotted rotatable outer tube. The outer tubes are connected through worm gears and a worm to an external pointer and operating handle. The liquid discharges from the main vessel into the weir stacks through slots and runs down directly to the reflux and product line connections. Movement of the control handle causes rotation of the outer slotted tubes in such a fashion that one slotted opening is decreased while the other is increased. The total free width of slot in both stacks remains always the same, but the ratio of the two slots is altered. At a given setting the discharge ratio of the two slots remains constant regardless of the total head of liquid in the vessel, and hence regardless of the total flow rate. The head in the vessel may be used as a rough measure of the total flow rate.

Another new development of the company is a specific gravity tester for distillation plant instrument panels, which is similar in appearance to a case type rotameter. Liquid enters at the bottom and rises in a glass tube containing a hydrometer, then overflows at a central level through overflow tubes, discharging to an outlet connection. Another new development is a filter for gasolines, solvents and light oils for use where it is desired to remove all foreign particles, even those too small to be visible to the naked eye. This is known as the Super-Clear filter. This was developed by the company to avoid altering the calibration of rotameters used on high accuracy tests where the accumulation of small quantities of solids on the metering float or tubes would interfere with accuracy. This filter employs a cartridge wrapped with a 200-mesh stainless screen around which is wrapped a specially developed hard-packed felt filtering bag.

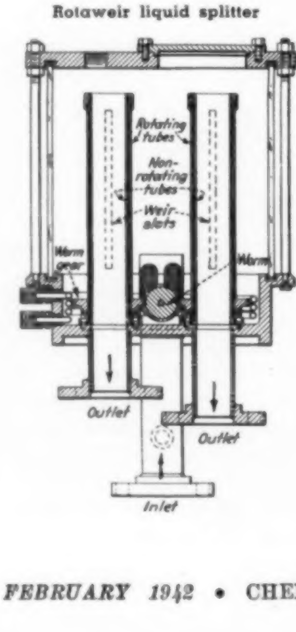
Protected Motor

A ONE-PIECE cast frame and cast endshields which guard the motor from exterior knocks and abuse, are important features of the new Lo-Maintenance motor with "SafetyCircle" protection recently announced by Allis-Chalmers Manufacturing Co., Milwaukee, Wis. The manufacturers stress the all-around protection which has been given this motor by means of the "Safety-Circle," which is a wide, solid rib, integrally cast as part of the frame, to form an unbroken "circle of protection" around the stator. More liberal use of electrical materials is said to make this motor electrically stronger than earlier models because current and magnetic densities are less extreme. Bearing design has been improved to insure proper lubrication and facilitate flushing of the bearings. Additional strength has been built into the rotor. Removable end brackets and a large conduit box for handy wiring are other features.

Level Controller

ELECTRONIC level control equipment available in a variety of types for either signalling or controlling the opening or closing of valves or the starting or stopping of pumps, has been developed by Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass. Controllers of the P16 series are adapted to the control of conductive liquids, while controllers designated as Type P30 are suitable for use with insulating materials such as mineral oils, paints and varnishes and similar liquids, as well as powders in bins. The equipment consists of an electronic relay for opening or closing an electric circuit, which is wired to one or more probes or electrodes attached to the tank or bin. For both high and low level control, for example, a probe would be attached both at the low point at which pumping should start and at the high level where pumping should stop. When the liquid level falls to the lower probe, the level control starts the pump in operation and the tank fills. When the level rises to the upper probe, the liquid acts as a conductor, operating the level control and stopping the pump. Even with non-conductive liquids, the probe circuit carries so little current at such a low voltage that it is claimed to be effective. Several types of probe are available for different applications, including boiler feedwater control. A variety of construction materials can be employed to suit both corrosive and non-corrosive applications.

Rotaweir liquid splitter



Industrial Ozonizer

ALTHOUGH it was developed primarily for use as a mobile water treatment unit for army camps and troops on maneuvers, the new Sterozone automatic ozone water-treating plant developed by Technicraft Engineering Co.,

New Lo-Maintenance motor

Portable ozone water treater

Los Angeles, Calif., is stated also to have numerous industrial applications. This unit has a rated capacity up to 9,000 gal. per hour and can be employed in parallel with other units under automatic control for larger supply requirements. Raw water is pumped from its source to a filter to remove suspended matter and then passed to an absorber chamber where ozone, generated by a high frequency silent electric discharge, oxidizes the bacterial contamination and delivers purified water without taste or odor. The unit receives power from an automatic gasoline-engine-driven 10 kv.-a. power plant which is self-starting and self-regulating. All mechanism is driven by a 5-hp. electric motor on which the treated water supply pump is mounted. The other end drives the raw water supply pump. Also driven from the motor shaft by V-belts are the compressor, cooling water circulating pump, and evaporative cooler. Operation is fully automatic, an electric timer controlling the cycle and periodically reversing the raw water filters and the air dehydrators. The filter out of service is backwashed and the dehydrator out of service is electrically regenerated.

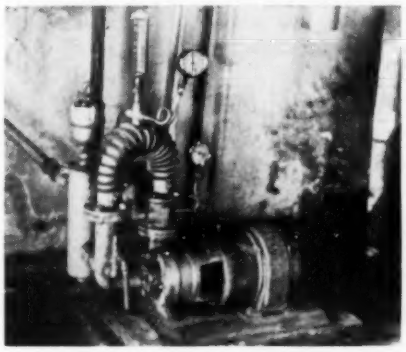
A smaller size of 1,200-g.p.h. capacity has also been announced.

New Mixers

Among new mixer developments of the Mixing Equipment Co., Rochester, N. Y., is a new V-belt-drive, top-entering mixer for use on open tanks, closed tanks, pressure or vacuum vessels and for attachment to standard-size nozzles. An advantage of the design is the flexibility of the drive, permitting easy speed change by changing the sheave and pulleys, or by use of a variable speed pulley on the motor to permit 25 percent speed variation. If desired, electrically conducting V-belts can be provided to do away with static electricity hazards. Oil-resisting belts can also be provided. Since a standard-frame motor is used rather than a gearmotor, delivery time is reduced. Units range in size from 1 to 25 hp. and can employ motors intended for special types of service, as well as various materials of construction for the agitator shaft and impellers.

Top-entering agitator

High-pressure condensate return system

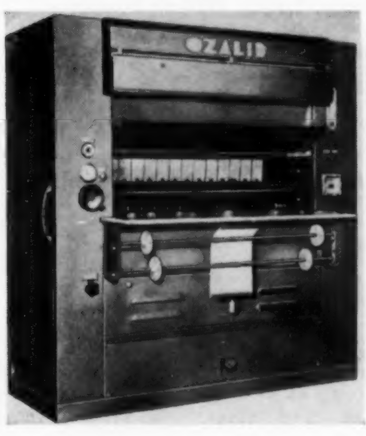


This company has also announced two new models of air-driven, portable, propeller-type mixers, for operation on air pressures from 60 to 120 lb. These mixers are not intended to supplant electrically driven types, but are designed for use in explosive atmospheres where the safety of an airmotor is desired. Compared with an electrically driven mixer with a semi-enclosed motor, the initial cost of an air-driven mixer is about the same. Compared with an explosion-proof-motor-equipped mixer, the air-driven model costs much less, but operating cost is higher. Speed of the airmotor can be varied by throttling. Type AR-25 operates at 1,550 r.p.m. with a 3-in. propeller and 36-in. shaft. Type AR-33 operates at 400 r.p.m., with a 7-in. propeller and 36-in. shaft.

Condensate Return System

Designed to return condensate to the boiler at high pressure, within a few pounds of the boiler pressure, and thus conserve heat, a new condensate return system has been introduced under the name of Cochrane-Becker by the Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia, Pa. The system consists of a specially designed centrifugal pump, direct-connected to its motor, which serves to circulate condensate at high velocity through a jet pump connected in a closed circuit with a "thermo-fin" priming loop. Flow of condensate from the heated equipment is induced by the jet and this condensate joins the liquid circulating in the loop. However, since the loop is operated full, an equal quantity of condensate must leave the system and discharge to the boiler. An air separator between the loop and the boiler relieves all air automatically. The system is said to operate without substantial drop in temperature and to return water to the boiler at maximum pressure. Flash is eliminated and under proper conditions, traps are not needed, or their use may be minimized. The system is provided with a high-pressure automatic air-relief valve, a thermometer, inlet and outlet pressure gages, a strainer, safety valve and motor starting switch. Several sizes and capacities are available to accommodate a wide range of pressure differentials.

Model B whiteprint machine



High-Speed Printer

Following the recent announcement of its Model C fast-printing whiteprint machine for the production of whiteprints at a speed of 12½ ft. per minute, the Ozalid Products Division of General Aniline & Film Corp., Johnson City, N. Y., has developed and announced the Model B machine for producing finished whiteprints at speeds up to 20 ft. per minute. This is said to be the highest speed in dry developed print making ever achieved. The new machine has such features as synchronized printing and developing, and use of continuous yardage, as well as cut sheets. A temperature control for the printing cylinder is provided so that the entire range of Ozalid sensitized materials can be printed with best results. Front or rear delivery of prints is provided, together with an adjustable burner shade to permit running prints of varying opacity without changing the printing speed. As in all of this company's whiteprint machines, the new Model B combines printer and developer in one compact unit. The machine can readily be installed in the drafting room, plant or office.

New Switch Design

Delta-Star Electric Co., 2400 Block, Fulton St., Chicago, Ill., has announced a new design of 3,000-amp., 23-kv. switch. The accompanying illustration

3,000-amp., 23-kv. switch

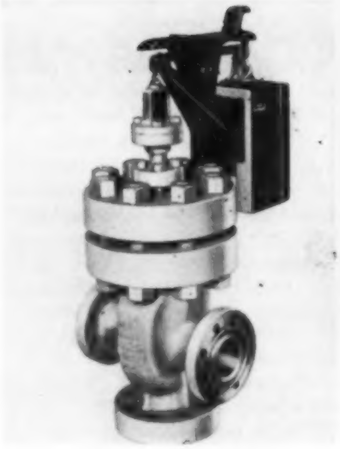
shows a single-pole unit of a three-pole switch. The switching element is a square copper tube blade which, by means of a 45-deg. bearing mounted on top of the center rotating insulator unit, is raised or lowered. The same movement also turns the blade corners into high pressure connection with fixed contacts on both blade ends. Coiled springs inclosed in circular housings at the hinged ends of the blade counterbalance it for easy operation.

Power Control Valve

The Ashcroft power control valve recently announced by the Consolidated Safety Valve Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn., has been designed for high pressure installations in the range from 1,800 to 2,500 lb. This valve, which is of an automatic relief type which may be set for a 1 per cent or smaller difference between opening and closing pressures, is said to effect a large saving over the 4 per cent required for spring-loaded safety valves. The principle of operation of the new valve is simple. The boiler drum or superheater outlet pressure or steam header pressure actuates a pressure control set at the popping pressure, which operates an electric contact on a difference in pressure of 1 per cent or less. The electric current operates a solenoid to open or close a pilot valve. When the latter opens, it unbalances the pressure over the main valve disk, opening it and holding it open until the pilot valve is closed. The new valve is not intended to replace spring-loaded safety valves, but rather to be used as a supplementary operating valve, designed to conserve power and increase the efficiency of the steam-generating plant.

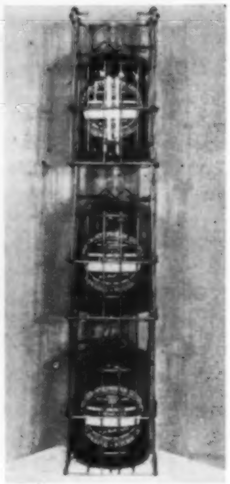
Squeegee Pump

Introduced in its original form shortly before the 1939 Chemical Exposition, the Huber pump is now being manufactured in an improved design by the Huber Pump Division of the Downingtown Mfg. Co., Downingtown, Pa. This pump consists of a flexible tube of rubber or synthetic rubber, formed to a U-bend and contained within a casing. Centered within the casing is a shaft carrying an eccentric which rotates within an anchored rocking compressor ring. Rotation of the shaft alternately squeezes and releases the tube in a rocking "squeegee" manner which gives the pump its name of Squeegee pump. The accompanying illustration shows the squeezing action at one point in the cycle of rotation. This action progresses from left to right, forcing liquid or gas through the tube without contact with the metal parts. A single-stage pump requires a check valve to prevent flow reversal when the cam is at the high point of the cycle, but a double-staged pump, such as is often employed,



New power control valve

Explosion-proof constant-temperature cabinet



Steel-X carboy carrier

is set with the rotors 180 deg. out of phase and so seals itself without use of a check valve.

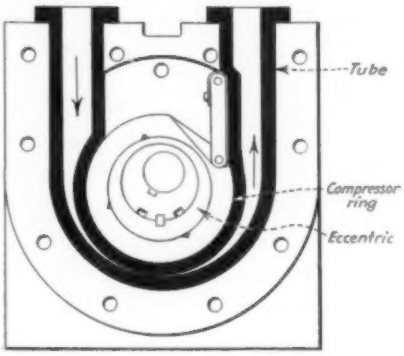
It will be noted from the drawing that the eccentric is made of two parts keyed together to permit adjustment for wear and also that the rocking ring is anchored by an arm to prevent its rotation. Both liquids and gases can be handled, as well as liquids containing suspended solids. It is claimed that there is practically no wear, even if the solids are abrasive. The pump is made in a number of sizes ranging from a 3-lb. midget of 6 g.p.h. capacity, made in bronze or transparent plastic, to a 3-hp. model of 50 g.p.m. capacity. Pumps can be double-staged in parallel to give capacity up to 100 g.p.m. They can also be double-staged in series to eliminate the check valve. These pumps are rated for 25 ft. suction lift, and discharge pressures up to 50 lb.

Constant-Temperature Cabinet

An accompanying illustration shows one of a new series of explosion-proof, constant-temperature cabinets, approved by Underwriters' Laboratories for use in Class 1, Group C or D hazardous locations, and made by Precision Scientific Co., 1730 North Springfield Ave., Chicago, Ill. Four standard sizes are available. There are no exposed contacts, electrical controls, switches or wiring terminals. Furthermore, safety release latches on the doors open instantly under pressure of an explosive burst occurring inside the cabinet. Special venting is provided to exhaust dangerous gases. Heating is by means of steam with a motor-driven turbo-blower employed to force circulation of heated air across the working chamber. Temperature may be held within the range from 35 to 150 deg. C., under automatic control.

Carboy Carrier

Weight reduction of 40 lb. per carboy, as compared with the conventional 12-gal. glass carboy and its wooden box, is claimed for carboys installed in the



Cross section of Squeegee pump

new Steel-X carrier, available both for 12-gal. carboys and 5-gal. glass bottles, and offered by the Carrier-Stephens Co., Lansing, Mich. This concern, a chemical manufacturer, developed the welded steel-wire-frame carrier for its own use and has decided to make the device available to other chemical manufacturers. In addition to its light weight the wire frame has a number of other advantages, such as full visibility of the carboy contents at all times, ability to be stacked vertically, and ability to drain the carboy completely. The carrier frame is cut away at one side to permit pouring without danger of the carboy contents coming in contact with the metal. Carboys installed in the new carrier may be moved with an ordinary two-wheeled warehouse truck. Although they are claimed to minimize carboy breaking, the carrier frames can readily be installed on new carboy bottles if breaking should occur.

Automatic Mixer Control

To provide for the automatic cycling of mixing operations in chemical processes, National Engineering Co., 549 West Washington Blvd., Chicago, Ill. has developed an automatic mixing control known as the National Automatic Time-Master. This system, which is applied to this company's muller-type mixers, consists of an automatic cycle

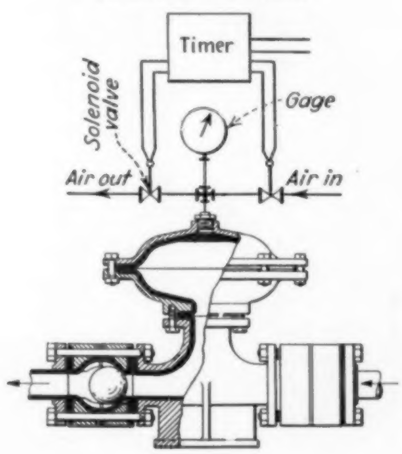
controller which operates pneumatic or hydraulic cylinders to control the various functions of the mixing cycle, such as charging the batch to the mixer, timing the mixing, and discharge. The exact combination of functions depends on the particular problem. For example, a solid material can be weighed automatically into the mixer and a liquid run in at a definite rate for a definite time. The controller will then cut off the flow of materials and mix the batch for a definite time, after which it will discharge automatically. If desired, an automatic moisture sampler can be provided in the solid material chute which, operating on the impedance principle, will measure the moisture content of the entering material and show on a dial how much liquid must be run into the mixer. The cycle controller, which is electrically operated by means of synchronous motors, can be set for either automatic or manual control and, if desired, will repeat each time a cycle is completed.

Diaphragm Slurry Pump

KNOWN AS the O.D.S. pump, a new diaphragm slurry pump introduced by Oliver United Filters, Inc., 33 West 42d St., New York, N. Y., has the unique feature of being actuated without mechanical linkage or other mechanical connection to the diaphragm.

Automatic mixer control

Diaphragm slurry pump



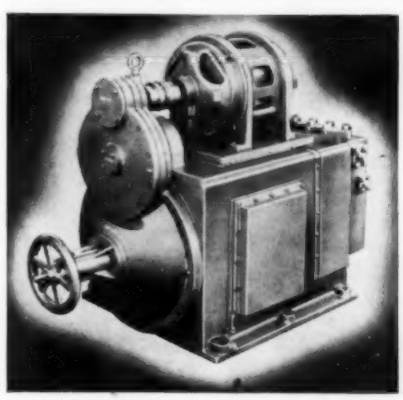
As shown in the accompanying illustration, a timed impulse of compressed air or vacuum is supplied directly to one side of a floating diaphragm and through this the energy is transmitted to the slurry or solution being handled on the other side. The pump is said to be especially suitable for handling most acids, neutral or alkaline slurries, either hot or cold. Since all parts coming in contact with the liquid are protected by rubber or neoprene, the pump resists abrasion as well as corrosion. Furthermore, lumps and strings are said not to clog it, if they will pass the ball valves. One particularly suitable use is for feeding and discharge of pressure and vacuum filters, because of availability of air and vacuum.

Since the pump is single-acting, it produces intermittent flow, although the pulsations can be partially smoothed by using an air chamber in the discharge line. Steady flow can be produced by using two or more pumps actuated by a single timer, with the pulsations staggered. Since the flow can be varied widely by changing the timing mechanism, the pump is said to be suitable for proportioning. Four sizes are available, ranging from 1 to 3 in., with capacities from 5 to 60 g.p.m. The electric timer can be of explosion-proof design if desired. However, the standard timer may be located at a distance to minimize danger. With compressed air only available, the pump operates on gravity fill and pressure discharge. If only vacuum is available, it operates on vacuum fill and gravity discharge. With both pressure and vacuum available for operation, it can employ vacuum fill and pressure discharge as well.

Variable Delivery Pump

STEPLESS CHANGES in capacity from zero to 6 g.p.m. at 5,000 lb. per sq.in. pressure can be accomplished with the new Stediflo variable-delivery pump recently announced by the Watson-Stillman Co., Roselle, N. J. The variable capacity feature is accomplished by a new driving member trunnioned on the drive shaft, the angle of which can be varied while the pump is running to produce a corresponding stepless change

Variable delivery pump



in plunger stroke from zero to full 4-in. stroke. The stroke control shaft is extended to the outside of the pump casing for attachment to either a manual or automatic control. The pump is intended especially for hydraulic press applications where rapid advance is to be followed by a slow movement at high pressure; and for boiler feed where sudden changes in output affect the water level. In the 6 g.p.m. size, the pump employs a 25 hp. motor and requires a 4x4 ft. floor space. Other units for pressure from a few hundred to 8,- 10,000-lb. per sq. in. can be supplied.

Equipment Briefs

TYPE AHV is the designation of a new industrial steam trap for straight-through horizontal or vertical piping, produced by W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa. This trap, which is of bronze construction for pressures ranging from vacuum to 200 lb., is of the thermostatic bellows type, designed for intermittent discharge. The trap is said to eliminate air-binding, to have large capacity and to require no adjustment. It can be used close to the floor, wall or a pillar, and is recommended by the maker for the individual trapping of unit heaters, plastic molding platens, and similar equipment. This trap is made in ½ and ¾ in. sizes.

A NEW rimless-type safety spectacle has been announced by the Tulca Division of the Univis Lens Co., Dayton, Ohio. The new spectacle, known as the "Supervisor," is fitted with the company's special non-glass safety lenses which are said to be of light weight but to afford excellent protection. The spectacles come with or without side shields.

A NEW TYPE of concentrating floodlight bulb designed for high-bay lighting in industrial plants, has just been announced by Wabash Appliance Corp., Brooklyn, N. Y. The new bulb is said to deliver a concentrated flood of light at long distances from the bulb. The filament is mounted at the exact focal point of a hump-shaped parabola forming the bulb, so that light rays are forced straight out of the bulb without waste. The inside of the bulb is lined with pure polished silver to form a permanent reflector. Several sizes up to 1,600 watts are available.

To PROVIDE lighting intensities from 30 to 100 footcandles with maximum diffusion and minimum glare at ordinary spacing and mounting heights, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has introduced the Type FPF-40 fluorescent luminaire which uses two or three 40-watt lamps per reflector and is designed to make possible any length of reflector strip desired, using only four simple and compact types.

CHEM & MET

PLANT NOTEBOOK

Timesaving Ideas for Engineers

DEWPOINT RECORDER FOR NATURAL GAS OPERATES ON SIMPLE PHOTOELECTRIC PRINCIPLE

J. A. SETTER *Industrial Dept., General Electric Co., Denver, Colo.*

A NOVEL dewpoint recorder utilizing a photoelectric relay to determine the temperature at which condensation occurs has been built and used this winter by the Colorado Interstate Gas Co. to prevent moisture condensation and possible freezing of its gas lines during cold weather. The company furnishes Denver with natural gas from Texas fields. The apparatus was designed and constructed by W. R. Beardsley and L. F. Carter, of the gas company.

With the new equipment, readings of the temperature at which condensation occurs are recorded automatically at frequent intervals at the point where the gas enters the Denver metering plant. If calculations based on the readings show the dewpoint temperature to be too high, instructions are dispatched to the dehydrating plant to lower the moisture content of the gas before trouble can occur.

The equipment consists of a small tank filled with anti-freeze solution, in which is immersed a U-shaped, highly polished, gold-plated tube. Through this tube passes a continuous flow of natural gas from a bypass valve in the main pipe line. Both ends of the tube are provided with plate-glass windows. Above the windows, a light source and photoelectric relay are mounted so that the light shines through the tube and is reflected to the phototube.

For controlling the temperature of the anti-freeze solution, the tank is cooled with coils of a small domestic refrigerator and heated with suitable strip heaters. As the cooling system reduces the temperature of the solution, the gas is chilled until a film of condensate is deposited on the inside of the highly polished tube, thus reducing the reflection of light to the phototube.

Since the latter is sensitive to a change of ½ foot-candle, it operates when condensate forms, disconnecting the cooling coils and connecting the heaters to warm the solution. When the solution is warm enough, the condensate disappears and the process is repeated. A small motor-driven stirring paddle in the anti-freeze solution equalizes the temperature of the bath.

A bulb-type recording thermometer records the temperature of the solution. On the same chart, the natural gas pressure is also recorded. From these two records, the dewpoint is calculated.

The temperature chart curve looks like a sine wave, with the tops and bottoms of the loops about 2 to 3 deg. apart, and with a frequency of about 10 to 15 minutes.

Schematic Diagram of Photoelectric Dewpoint Recorder and Associated Equipment

(A) Recording thermometer and pressure gage; (B) G.E. No. CR7505-N-100 photoelectric relay; (C) G.E. No. PJ 23 phototube; (D) G.E. No. A61 60-watt 110-volt clear bulb; (E) light receptacles; (F) Telechron 60-r.p.m. No. 3M12 motor and agitator; (G) throttle valve; (H) light reflecting boxes; (J) refrigerating expansion valve; (K) 1,500-watt Nichrome heating unit; (L) ¼-hp. methyl chloride refrigerating unit; (M) cooling coils; (N) condensing tank.

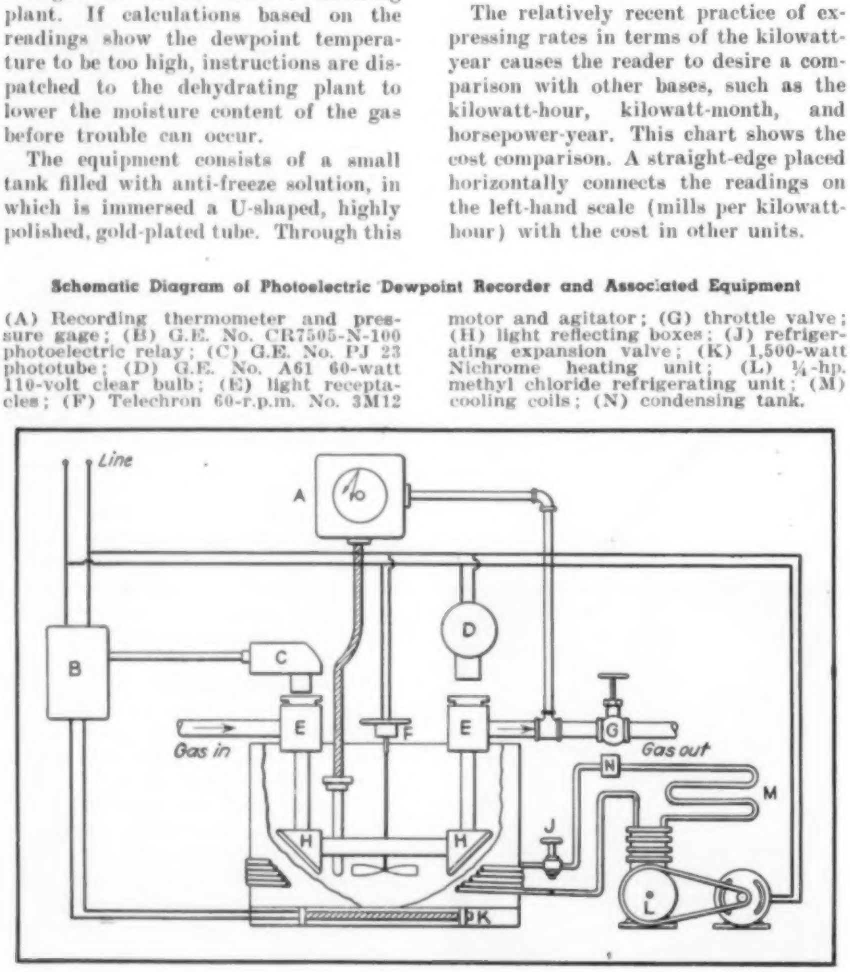
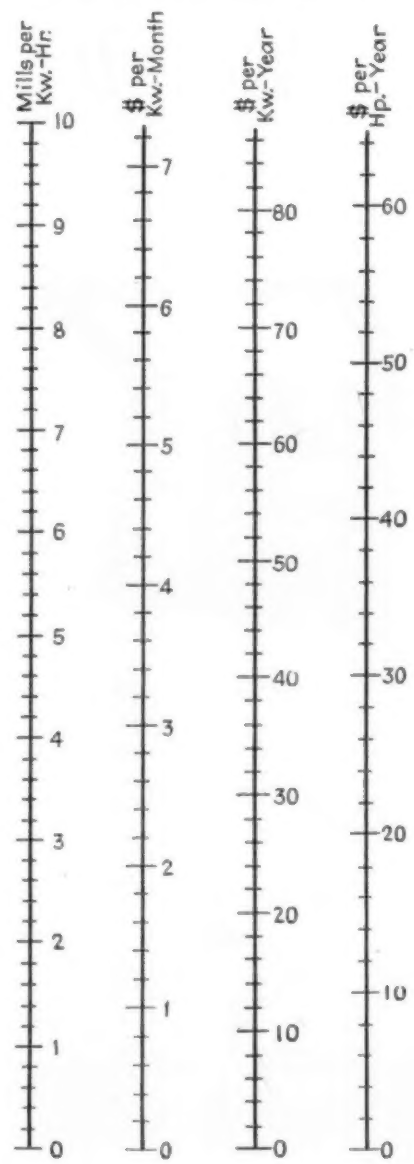


Chart Simplifies Power Cost Conversions

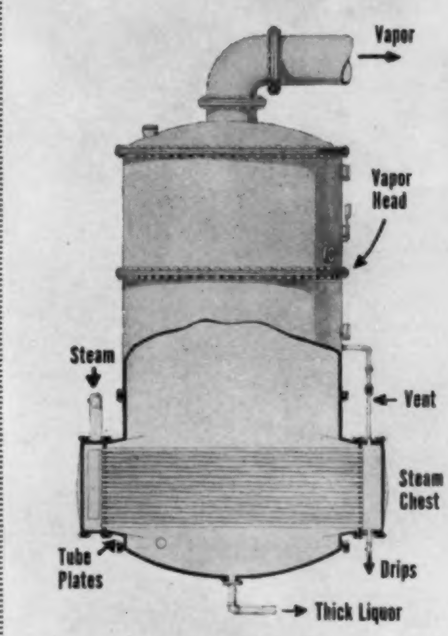
KENNETH A. KOBE
Department of Chemical Engineering
University of Texas, Austin, Tex.

The relatively recent practice of expressing rates in terms of the kilowatt-year causes the reader to desire a comparison with other bases, such as the kilowatt-hour, kilowatt-month, and horsepower-year. This chart shows the cost comparison. A straight-edge placed horizontally connects the readings on the left-hand scale (mills per kilowatt-hour) with the cost in other units.



Horizontal-Tube Evaporators

For the evaporation of liquids that are not viscous and which do not deposit scale or crystals.



SWENSON ROUND-BODY HORIZONTAL TUBE EVAPORATOR

PRINCIPLE OF OPERATION

In the Swenson horizontal-tube evaporator, steam is fed into one steam chest and is directed through the horizontal tubes to heat the liquid surrounding the tubes in the bottom of the evaporator body. The definite path followed by the steam assures that all non-condensed gases and condensate are swept to the opposite steam chest, where they are withdrawn. The velocity and paths of circulation of the liquid depend upon the distribution, size, and shape of the heating surface in the liquid compartment; these features are varied by Swenson engineers to meet particular requirements.

Evaporator equipment may be classified, in general, as horizontal-tube, calandria-type vertical, basket-type vertical, forced-circulation, and long-tube or film type vertical evaporators. For simple evaporation, where the liquids are not viscous and do not deposit scale or salt, the horizontal-tube evaporator is frequently found to be the most adaptable.

ADVANTAGES

Outstanding among the advantages of the horizontal-tube evaporator are: (1) its relatively low cost per unit of heating surface; (2) its extreme simplicity; (3) easy renewal of the heating surface; (4) sectional construction, with consequent low cost for partial repairs; (5) ease of operation; (6) its ability to carry a large volume of liquor in the body when finishing to a definite density; (7) its low headroom; and (8) the small cargo space required for shipment. All of these features assure low cost, efficiency, and easy operation.

LIMITATIONS

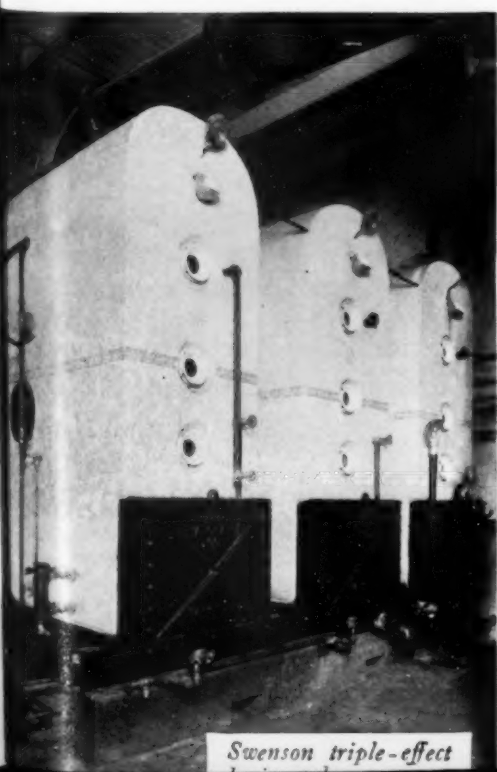
While the above advantages are desirable in almost all instances, certain definite limitations of the horizontal-tube evaporator must always be considered. For example, it may be used only when rigorous boiling can be obtained with natural circulation. This frequently precludes its use with viscous liquids. Also, because the boiling liquid is outside of the tubular heating surface, the horizontal-tube evaporator is not easily cleaned by mechanical means; consequently its use should be avoided when scaling or salting liquids are involved.

CONSTRUCTION

Swenson horizontal-tube evaporators are designed with either rectangular or circular cross-sections, with tubing of stainless steel, aluminum, nickel, carbon, spellerized iron pipe, lead-covered copper, or special bronze. The tubes extend between two steam chests and are fastened to tube sheets. Four-hole packing plates force down conical gaskets around the tube ends into counter-sunk holes in the tube sheets. Secure sealing is obtained, with facility for quick and easy renewal.

APPLICATION

Horizontal-tube evaporators are widely used in the evaporation of sugar syrups, Twitchell sweet water, tank water, beef extract, phosphoric acid, zinc chloride, and numerous other liquors which do not scale or deposit salt.



Swenson triple-effect

SWENSON EVAPORATOR COMPANY

Division of Whiting Corporation • *15669 Lathrop Ave., Harvey, Ill.*

SWENSON

EVAPORATORS

FILTERS • CRYSTALLIZERS

Ammonia-Soda Process

Most of the soda ash and about half of the caustic soda consumed in the United States is produced by the ammonia-soda process which had its beginning in Europe in the 1860's. In the intervening years many improvements have been made in the process and equipment, although the reactions are much the same as they were 80 years ago when the process was first commercially successful. The culmination of the years of experience in working out new and improved technique can be seen in one of the most modern plants in the country, that of the Mathieson Alkali Works at Lake Charles, La.

Several interesting features were incorporated in the construction of the buildings, some of which may be noted in the accompanying illustrations. The sides of several of the processing buildings have been left open, which was possible because of the mild weather prevailing the year round in this locality. All structures are of fire-resistant construction. Although strong winds are not prevalent in this region the tall buildings and towers were designed to withstand 120-mile wind velocities, because a high wind usually hits this section of the country at about the time of the autumnal equinox.

One of the important raw materials is brine which is brought to the plant in an 18-mile pipeline. The carefully purified brine is pumped to a head tank where it flows to the absorber tower. Here it is saturated with ammonia gas. The ammoniated brine is treated in a carbonating tower with carbon dioxide gas from kilns and rotary furnaces. The resulting suspension of sodium bicarbonate in an ammonium chloride solution is filtered in a rotary drum filter. The washed sodium bicarbonate drops onto a belt conveyor which feeds the furnaces in which the bicarbonate is decomposed by calcination into soda ash, carbon dioxide and water. The ash is stored in several concrete silos. It may be either shipped or converted into caustic soda.

Soda ash is causticized in large tanks. The milk of lime for the operation is made by burning the caustic mud and slaking. After causticizing the material is pumped to a bell settler in which the calcium carbonate mud is separated. The resulting lye is then evaporated in multiple-effect vacuum evaporators to 50 percent solution and pumped to storage tanks.

The milk of lime for the liming operations in the ammonia still is prepared from oyster shells. The shells from Calcasieu Lake and coal are received on barges. These materials are unloaded by crane and dropped onto a belt conveyor which carries them to storage piles near the loading ends of the lime kilns. The oyster shells pass through a rotary washer where the mud is removed. The reclaimer loads the lime and coal onto another belt conveyor which delivers them to bins above the kilns. The shells are burned and lime slaked.

CHEMICAL & METALLURGICAL ENGINEERING

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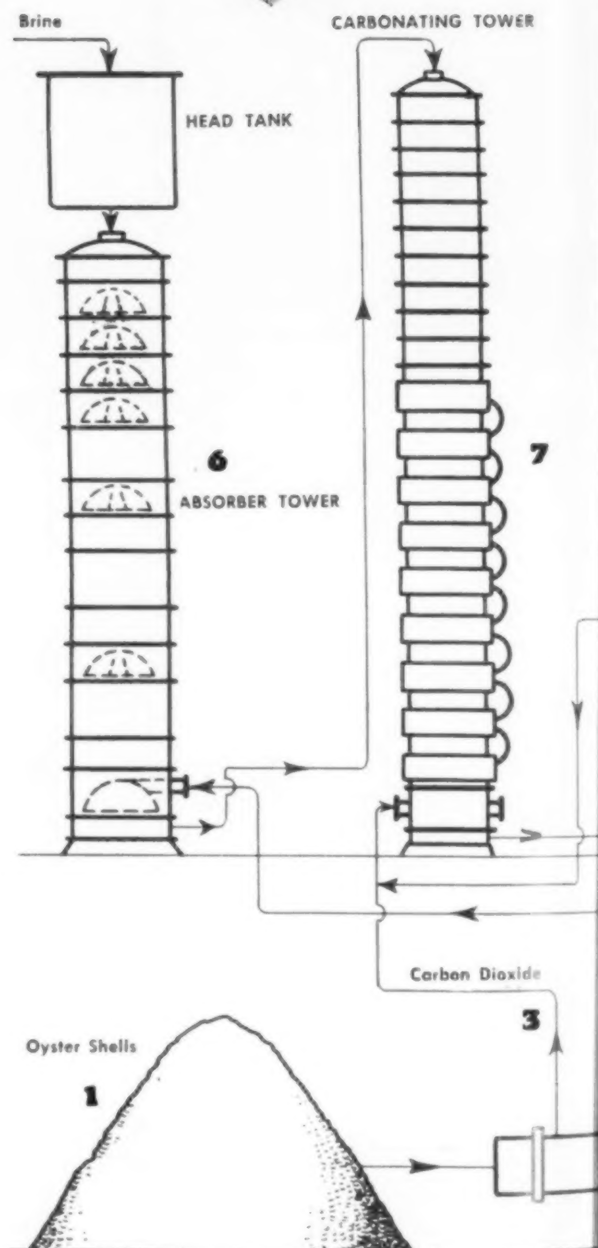
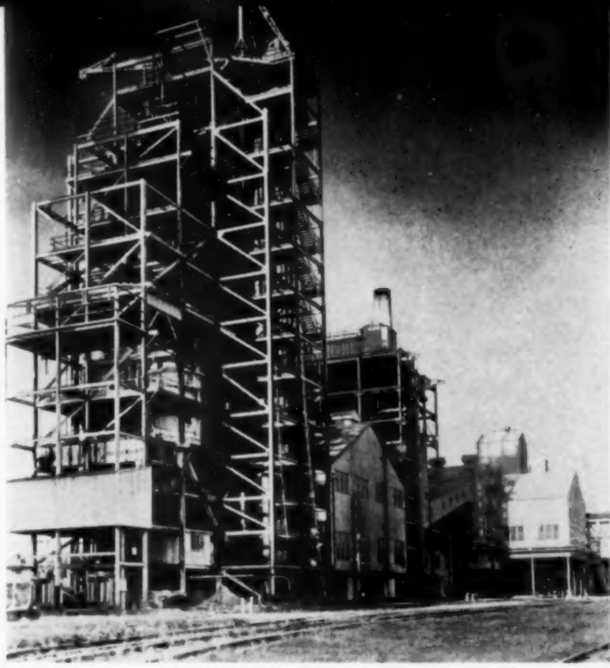
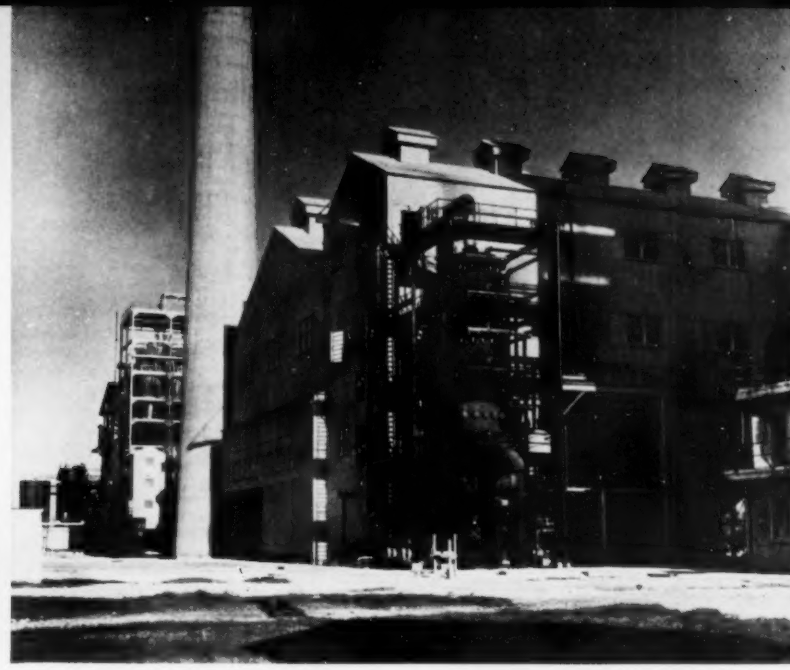
A *Chem & Met* **FLOW SHEET**



1 Oyster shells dredged from the dead beds of Calcasieu Lake and delivered by barge are a principal raw material

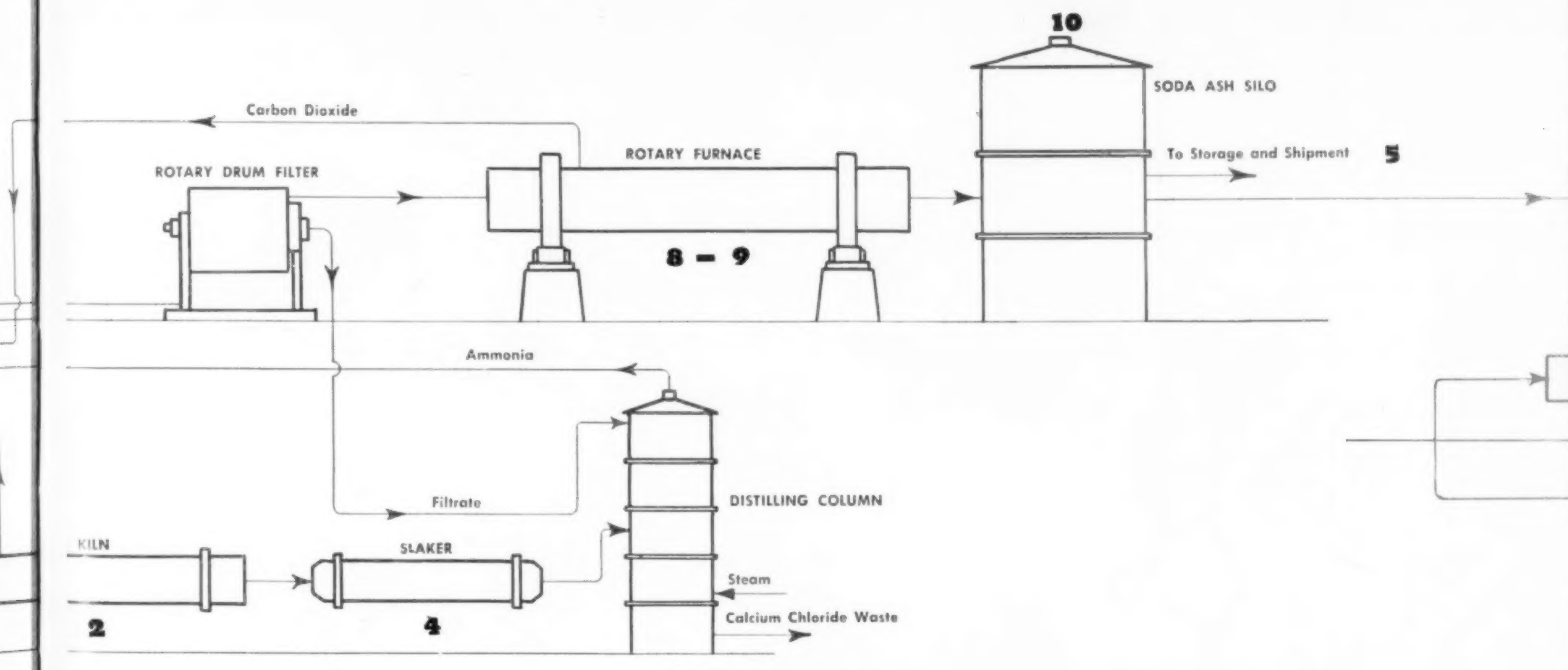


6-7 On left are ammonia absorption and recovery towers and on right are carbonating towers and filter building



8 In rotary furnaces in this building the sodium bicarbonate is decomposed by calcination into soda ash, carbon dioxide and water

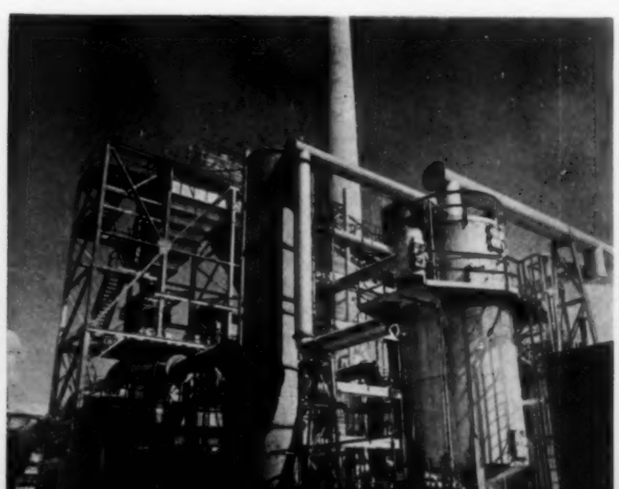
9 Carbon dioxide gas from the naces goes to the carbonating to

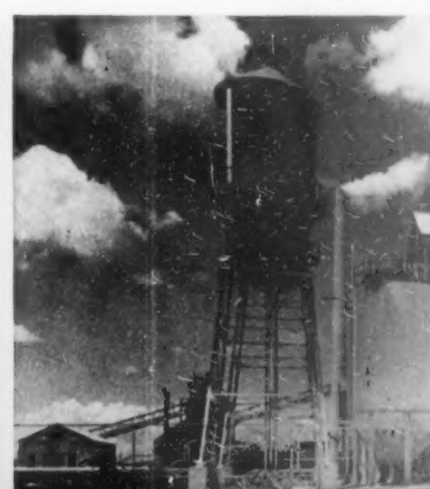


2 Shells, coal and coke are delivered to bins above the kilns and from them fed into the kilns where they are burned

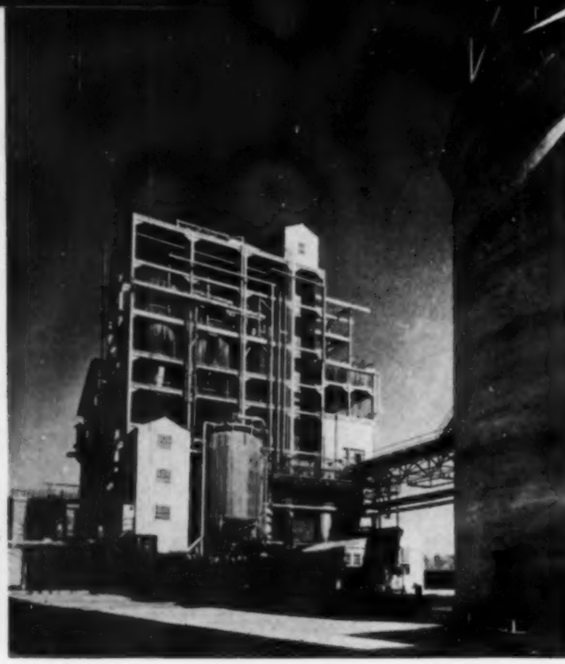
3 Cardon dioxide passes through a series of dust collectors and scrubbers before going to carbonating towers

4 Burned lime passes directly from the used is the rotary slaker which has a

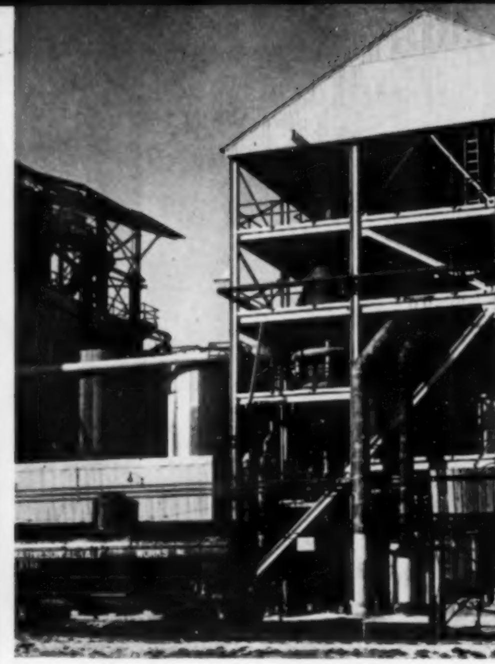




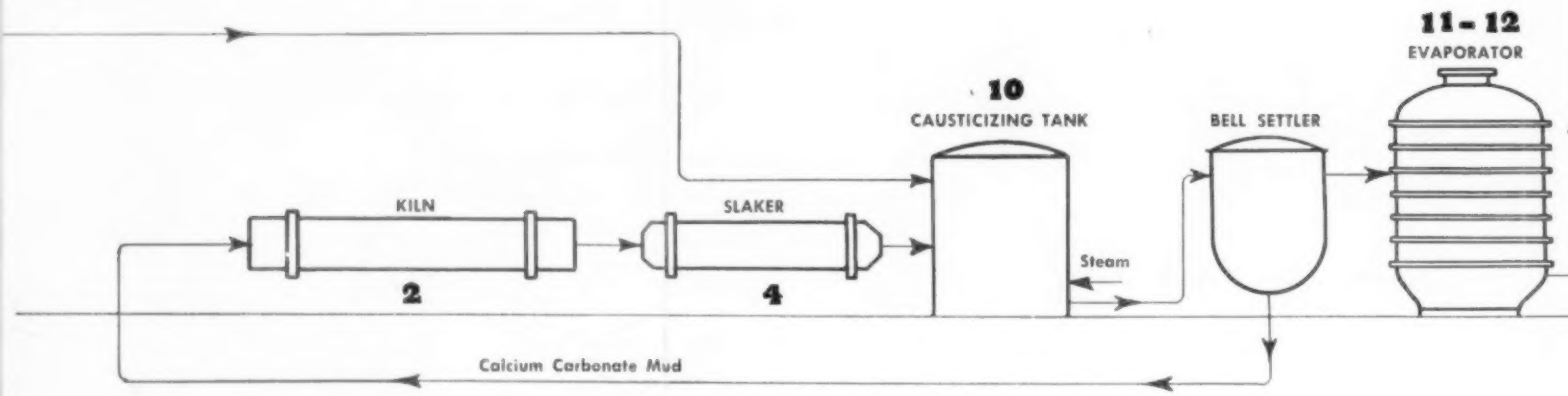
arbon dioxide gas from the operation in the fur-
s goes to the carbonating tower



10 Frontal view of caustic plant showing the causticizers with soda ash storage silo in right foreground

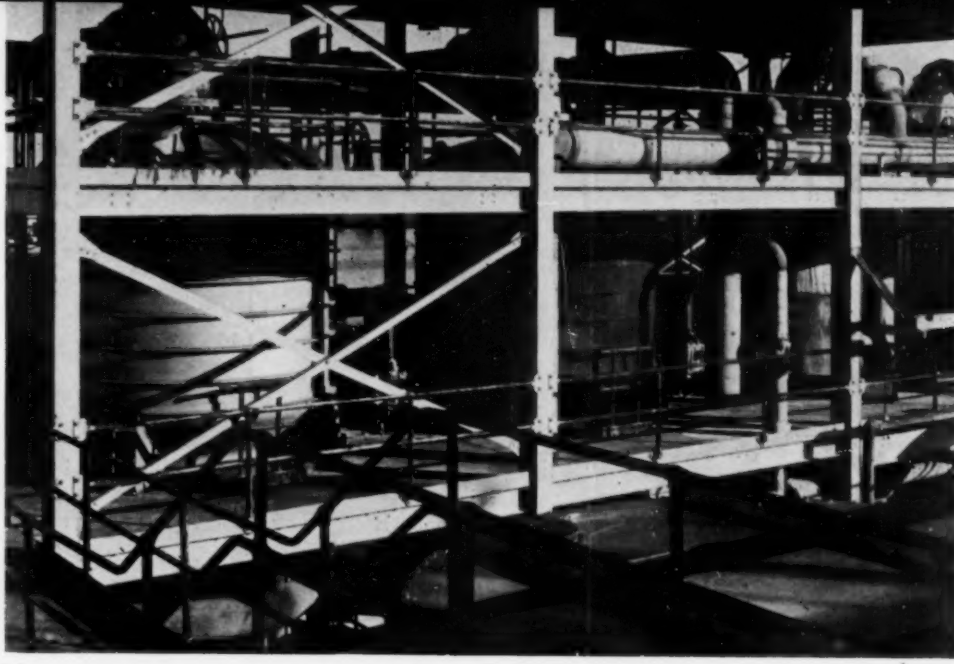


11 Caustic evaporation (right) where weak ca
centrated and bell settlers (left) where calcium



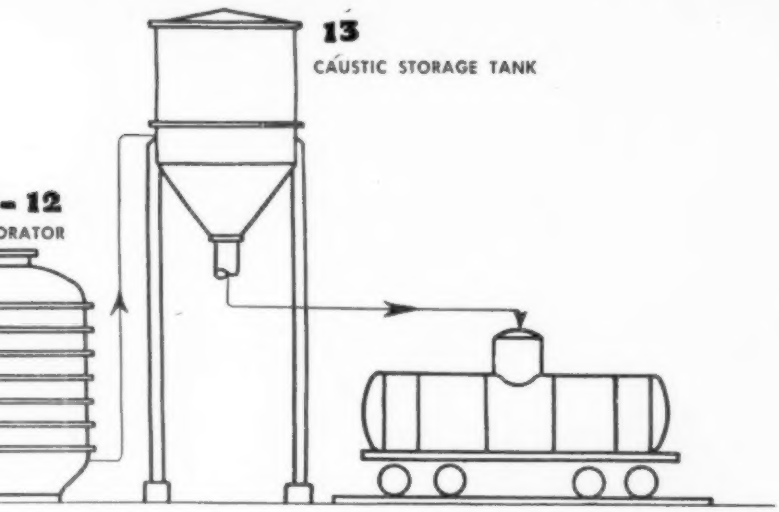
lime passes directly from the kilns to the slakers shown here. The type now most commonly
rotary slaker which has a large capacity and is continuous in operation

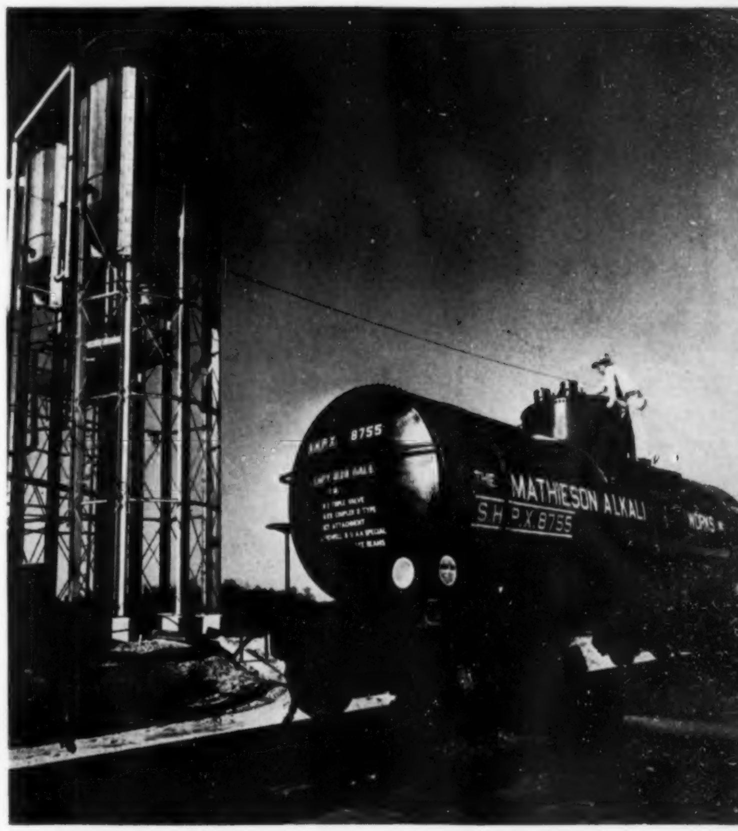
5 Ash is stored in bins at the top of the building, from
screened and fed into box cars or into bag filling equip



ere weak caustic solution is con-
here calcium carbonate is settled

12 After calcium carbonate mud has been separated in bell settlers the lye is concentrated in multiple-effect vacuum evaporators





13 Storage tanks for liquid caustic with tank car loading 50 percent caustic. It is also shipped by boat

uilding, from which it is
filling equipment

Lake Charles plant of Mathieson Alkali Works has interesting features in construction of buildings. Sides of several process buildings were left open. This was possible because of the mild climate

Technical, Industrial, Personal

CHEM & MET NEWS

CHEMICAL INDUSTRY GETS HIGH PRIORITY RATINGS

A detailed and relatively liberal priority "charter" to enable all segments of the chemical industry working on war or essential civilian production to obtain a steady flow of repair and maintenance equipment and operating supplies was issued by the War Production Board Jan. 26.

The order follows the general pattern of several other specific industry priority procedures for repair and maintenance materials but the ratings allocated to users are higher than any others except the mining industry. Administration of the procedure is assigned to the Chemical Branch of WPB.

Priority ratings available to those concerns accepting the order's terms are: A-1-a, to repair actual breakdown or suspension of plant operations; A-1-c, to maintain a minimum inventory to avert an immediately threatened breakdown or plant suspension; A-3, to obtain materials for normal repair and maintenance and operating supplies, subject to certain inventory restrictions.

In addition, an A-3 rating is granted to suppliers of repair and maintenance materials to enable them to obtain the components required to fill orders rated under the system.

This chemical industry repair and maintenance plan is identified as Priority Order P-89, and those accepting it will discontinue using the general industry repair and maintenance order P-100. Concerns desiring to use the ratings permitted under the order must first file formal acceptance of its terms with the Chemical Branch. They must also serve upon suppliers copies of the order and a blank acceptance form which the supplier must file with the Branch.

Use of the A-1-a and A-1-c ratings is permitted only after specific telegraphic permission is obtained in advance from the Chemical Branch. The A-3 rating may be applied automatically after acceptance of the order by concerns which are granted a serial number from Washington. A specified form of endorsement of A-3 orders is provided.

Inventory restrictions stipulated in the order require concerns using the ratings to keep their inventories to a minimum level necessary to sustain their current rate of operations, but in no case in excess of the ratio of average inventory to average operations for the years 1938, 1939 and 1940. This is the most liberal inventory control in any industry repair and maintenance order now in effect. The others limit inventories to dollar value ratios, which, in view of higher prices, generally force reduction in the volume of materials in stock.

MONSANTO ERECTS ARMY PLANT BELOW ESTIMATED COST

The Chemical Warfare Service's St. Louis Plant No. 1, located at Monsanto, Ill., has been turned over to the army by Monsanto Chemical Co., the engineering and supervising constructing contractor, on time and at a cost less than estimates and for a supervising fee less than the government's agreement called for.

In turning over the plant to the army, Edgar M. Queeny, president of Monsanto, informed the Monsanto organization:

"When we contracted with the government for the engineering and construction supervision of this plant, we asked, and the government agreed, that no profit should accrue to the company for the work involved. We hoped that no loss would be involved.

"Allowing for changes in design necessitating minor alterations in the construction schedule, the plant was completed and has been turned over on schedule. The plant originally contemplated was completed for approximately $200,000 less than the estimate furnished by Monsanto to the War Department. The fee allowed by the War Department to Monsanto to cover cost of supervision exceeded Monsanto's actual cost by an appreciable amount. Monsanto has returned this sum to the government."

The chemicals to be produced in the plant, according to the Chemical Warfare Service's original announcement, are to be used by the service in the manufacture of gas protective equipment for troops.

Presentations of the Branch of Ordnance flag and the Navy "E" for excellence in production of naval ordnance material to units of Monsanto Chemical Company have been made by representatives of the Secretary of the Navy. The awards, which were the first made to any ordnance manufacturer for production of raw materials, were given to the Monsanto Phosphate Division plants at Anniston, Alabama, and Monsanto, Tennessee, and at St. Louis to the executive branch of the company.

NEW PACIFIC COAST PLANTS TO USE BONNEVILLE POWER

Administrator Raver has informed his staff and the Pacific Northwest War Industries Commission, in which the power administration and the state administrations of Oregon and Washington participate, that he had made commitments to the Defense Plant Corp. and the new War Industries Board to serve the new industries with a total of 190,000 kilowatts of power.

The new plants include the newly announced shipyard at Vancouver, Wash., which will be supplied with 8,000 to 10,000 kilowatts; additional aluminum capacity to be served by 30,000 kilowatts; an electrochemical plant, 12,000 kilowatts; a phosphorous plant, 40,000 kilowatts; a second phosphorous plant, 25,000 kilowatts; a ferro-silicon plant, 25,000 to 30,000 kilowatts; and an electrometallurgical plant, 50,000 kilowatts.

With the exception of the already announced shipyard at Vancouver, the sites for the industries have not been definitely determined by the Defense Plant Corp. Names of the companies which will operate these plants also were not announced.

Raver's report came just two weeks after he had left his Portland office for Washington, D. C. to inform defense officials that the Bonneville Administration could make available 180,000 kilowatts of power capacity for industry over and above its present industrial contracts and commitments, by the autumn of 1942. Raver also said he expected that the entire new industrial load would be developed before the close of the year, and that some of the plants probably would be in operation long before that date.

Addition of the six new industries to the power administration's growing list of customers increases the government's Columbia river power load under contract or commitment to more than 700,000 kilowatts, and the number of Bonneville's war industry customers to 19.

T.A.P.P.I. ELECTS OFFICERS FOR ENSUING YEAR

At its annual meeting, the Technical Association of the Pulp and Paper Industry elected R. A. Hayward, president and general manager of Kalamazoo Vegetable Parchment Co. as president of the association for the ensuing year. V. P. Edwards, sulphite superintendent, International Paper Co., Palmer, N. Y., was elected vice-president. New members of the executive committee are Worthen E. Brawn, general superintendent, Pejepscot Paper Co., Brunswick, Maine, O. P. Gephart, superintendent, Maimisburg Paper Co., Maimisburg, Ohio, Charles R. Seaborne, vice-president, treasurer, and general manager, Thilmany Pulp & Paper Co., Kaukauna, Wis., and R. S. Wertheimer, vice-president, Longview Fibre Co., Longview, Wash.

News from Washington

WASHINGTON NEWS BUREAU, McGRAW-HILL PUBLISHING CO.

PRODUCTION goals for chemicals and the products of chemical industry climb steadily. Programs thought very satisfactory in December are quite inadequate as February begins. Almost every commodity is becoming scarce if it has even indirect relation to any industrial activity which is permitted in war time.

Serious shortage of many very ordinary chemicals is feared. Strenuous effort is being made to increase output of sulphuric acid far above the 1941 record. More products of electrochemical industry will be provided for in contracts pending, notably aluminum, magnesium, chlorine and caustic, ferro alloys, and a score of others. In this particular field the limitation of power supply is proving one of the more significant handicaps.

Rubber Problem

Official announcement was made in January of the intention to complete by mid-year 1943 a capacity to produce 400,000 tons per year of synthetic rubber. About one-fourth that capacity exists today. The present capacity will be doubled by the end of the year. Another doubling in the following six months is sought.

This program depends on new facilities for manufacture of butadiene, styrene, and other rubber-making chemicals, and on the ability to get polymerization and rubber processing machinery promptly. Aggressive effort is being made by petroleum, chemical, and rubber companies, each working in its specific field.

High priority ratings are being assigned for all necessary materials of construction and in the equipment shops. To some extent a pooling of patents is being arranged to facilitate quick action by as many companies as may be necessary to secure maximum output. A tie-in with aviation gasoline, toluol manufacture, and the alcohol program, is being arranged by the chemical executives of W.P.B. under the personal direction of E. R. Weidlein.

Tariff Repeal

To secure Latin American cooperation, generous promise was made by the U. S. delegates at Rio de Janeiro regarding our concessions. Undersecretary of State Sumner Welles evidently pledged to our Latin neighbors a removal of all tariffs and other trade barriers restricting goods movement that is important for war activity. It has been announced in the daily press that at least fourteen agreements were signed by the United States representatives with certain Latin countries, presumably including an agreement along these lines as to tariffs.

Up to Feb. 1, these "treaties," or whatever the agreements prove to be, had not been officially released. It was not indicated whether they would be submitted to the Senate for approval or whether some sort of war-time authority of the President could be drawn on for carrying out of Uncle Sam's obligation so established.

Other cooperative measures for Hemisphere aid have been indicated. They include establishment of a labor exchange to provide adequate skilled labor wherever it may be needed. Pooling of transport facilities is promised so that our Latin neighbors can get essential supplies for the well being and comfort of those countries. A sharing of scarce materials is promised, even so scarce a commodity as tinplate to insure a certain amount of canning of fruits and vegetables in Chile and presumably of beef in the Argentine.

No open wrangles had developed at the end of January in Washington. But behind the scenes there was both compliment and bitter criticism. Presidential establishment of the United States on a "free trade" basis was charged. Some difficulty with Senators from the Western mining states and with the farm bloc in Congress is expected if legislation is required for carrying through this program.

Incendiary Fire Control

Fighting magnesium fires in production plants was studied by the U. S. Bureau of Mines at its Pittsburgh station. A novel method of extinguishing flaming metal was developed which appears to have very wide possible application. This method is applicable to fires started by small incendiary bombs dropped from aircraft, and for certain other types of firefighting in any division of industry, or even in the household.

"The extinguishing agent used is a very hard coal-tar pitch (approximately 300° F. softening point), sometimes commercially designated as 'fuel pitch.' The size of pitch recommended for this use passes a ¼-inch mesh sieve and is coarser than 35 mesh; particles finer than 35 mesh should not be used. When spread over a hot magnesium fire the pitch softens and seals the burning magnesium metal with an airtight blanket, thereby smothering the flames. The pitch is nonabrasive, easily available, and cheap."

When the fire is on metal or dry concrete or dry ground, the pitch is spread (do not throw) with a long-handled scoop or shovel. If the first application is not enough, supplemental applications will quell the blaze completely. After the fire is extinguished, the mass is allowed to cool and can then be rolled up like a carpet or removed from the surface on which the fire took place. If the fire is initially on a wooden floor or wet ground, a little more care is necessary. A small amount of pitch is first spread on the fire to reduce the heat and glare. Then, more pitch is spread alongside the burning mass which is then rolled over onto this pitch to complete the smothering.

If the adjoining floor or structure is ablaze before fire-fighting can begin, the customary methods of fighting such fire may be used. But great care should be taken to avoid throwing in a solid stream either water or any carbon tetrachloride extinguisher onto the magnesium. A water spray helps and certain foam extinguishers may assist in restraining the fire, but cannot safely be applied directly to the blazing metal.

Explosive Licenses

During January the Bureau of Mines began to administer the new law providing for the licensing of all those who manufacture, market, or utilize explosives or certain important ingredients of explosives. The first set of regulations were published officially in the Federal Register of January 16. (Copies are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.) Those requiring a copy of the Act governing the licensing operations should secure a copy of Public Law 381 of the 77th Congress. (This also is available from the Superintendent of Documents, at five cents per copy.)

Each company requiring explosives will get a purchasers license, described in the regulations as follows: "This license authorizes the purchase, possession, and use of explosives and ingredients. It permits no disposition of the explosives or ingredients purchased except the use thereof by the licensee."

Each employee of any company who has supervisory charge over storage or issue of explosives will get a foreman's license. "This license authorizes the purchase and possession of explosives and ingredients and the sale and issuance thereof to other employees of the licensee's employer, for use on the operating premises." It is not required that the individual worker, who simply procures his supply of explosive from day to day, be individually licensed. However, all of those whose duty includes issue or supervision of use do require licenses.

Alcohol Program

Fantastic figures are talked whenever the alcohol program is discussed about Washington. Production during the past year has undoubtedly far exceeded any previous record. Both the requirements and the output of 1942 will be substantially greater. The controversy over these plans will probably be bitter because much of the public is involved, and deeply interested. The fact that every housewife will think that her sugar bowl is empty because some supplies are being di-

verted to alcohol manufacture does not make solution of the problem a bit easier.

There seems no doubt that almost every facility for distilled liquor manufacture will be diverted to industrial alcohol making soon. The very few exceptions will be those plants which may be required to make beverage alcohol, gin, or rum, of which commodities there is not a long-term stock as there is of whiskey. A pooling of supplies of these specialties will make it possible for most plants to run 100 per cent on industrial alcohol and draw their supplies of the specialties from a few plants assigned to serve the whole industry.

The alcohol-making capacity of the beverage plants is substantially greater than the total peace-time demand for alcohol. It probably exceeds the alcohol which can be made from the low-grade black strap which is unfit for food purposes. Together the black strap and the beverage plants will supply well over half of the maximum estimate of requirements for the coming year. To make up the balance there will undoubtedly be use in alcohol plants of some molasses that could be utilized for food purposes. However, the inevitable sugar shortage makes some persons advocate the withholding of all this edible molasses for food. It is doubtful whether that extreme policy has any general acceptance; certainly it has not with those responsible for the military program. The question thus becomes one of determining at what point we shall stop making alcohol from edible molasses, as a matter of public policy.

To some extent other incidental sources of alcohol can be drawn on. Fermentation of certain wastes is planned. Substantial increase in synthetic alcohol capacity is being arranged. Some plants not fully equipped to ferment corn are adding facilities for that purpose to augment their output when molasses supplies are curtailed.

Much of the present difficulty in programming adequate alcohol manufacture comes from the fact that a great deal of butadiene for synthetic rubber must be made from alcohol as the primary chemical raw material. More emphasis is being given to making butadiene from petroleum cracking, or as a byproduct of aviation gasoline and toluol manufacture. To the extent that butadiene can come from such sources, it will relieve the alcohol demand, and hence the sugar shortage will be affected by the methods used in its manufacture.

Multiplication of the ammunition program will probably not increase alcohol demand proportionately. Relatively less smokeless powder is needed, as the use of aircraft increases faster than the use of naval rifles and big land guns. Under these circumstances, the ammonia and magnesium demands increase relatively fast and the alcohol, alpha cellulose, and perhaps even the toluol needs, are relatively less. But no one expects that the demand for any of these explosive raw materials will be met with too great comfort, as the aggregate requirement is unbelievably large.

Chemical Miscellany

Action Now!—No matter what it may cost, action at this time toward new production of needed chemicals is expected by Washington. Contract details are to be settled later, according to Donald Nelson. This program is not difficult when dealing with Army and Navy officials who have certain standard contract arrangements. But some companies report extreme difficulty when dealing with unusual contract situations at RFC. Legal quibbling there continues, according to many reports at the Capital.

Price Control—Leon Henderson is price-control boss with plenty of authority to put into force any needed system of licensing or regulation. The restrictions on price control for agricultural commodities voted by Congress, against the President's wish, may not work out as farm aid groups have wished. Secretary Wickard has greatly disappointed farm-state congressmen in his first comments on these matters. Obviously the price-control law is still very weak as it affects agricultural commodities; and it does nothing at all to control wages.

Farm Goals—The agricultural production goals fixed during January by the Department of Agriculture far exceed any previous record. They require greater use of agricultural chemicals for fertilizer, insecticide, and other purposes. Allotments of scarce metals for farm machinery will permit prompt delivery of machinery and of repair parts. The farm industry will have "business more than usual," if they can get sufficient labor.

Anti-freeze Supply—Use of methanol for anti-freeze is forbidden by an order of January. This leaves the whole job of protection of motors from freezing on industrial alcohol. It is hoped that numerous plants which cannot make 190 proof alcohol may supply a lower concentration material for anti-freeze use. This would make unnecessary the building of equipment for concentration of the alcohol to its normal 95 percent basis. Slightly greater bulk during shipping and storage is less objectionable than the job of getting such new equipment, Washington believes. And 60 percent or 80 percent alcohol can readily be used for anti-freeze.

Pulp Shortage—Allocation of certain types of pulp has begun, notably sulphite pulp for explosives. Shortage of other types is feared. Paper shortage is being experienced as a serious matter even in some defense industries. Every industrial enterprise using paper in any form is being urged to study its requirements, and to reduce these to the very minimum, regardless of the type of paper or pulp required. Military consumption of paper products is proving greater than anticipated, especially for container manufacture. Shifting to more abundant wrapping materials, or the use of none at all wherever feasible, is strongly advocated.

"Poison" in Food—Food and Drug Administration has specifically forbidden the use of monochloracetic acid in any amount as a food or beverage preservative. This material has been used in small quantities by certain beverage manufacturers, especially to prevent spoilage of carbonated drinks. This chemical is regarded as highly toxic by F&DA; and its use even in the most minute quantities will, therefore, make a food subject to seizure and destruction.

Trade Agreements—A trade agreement negotiation with Peru has been in progress during late January and early February. Being considered are tariff cuts, or agreement to freeze tariffs or free list items, on tungsten, vanadium, bismuth, sugar and numerous materials used in tanning or as insecticides. Washington anticipates that the State Department will continue thus to cut many tariff rates to half. Such changes are made under the present trade agreement law and do not require any demonstration of emergency.

Price Bonus—To stimulate further output of copper, lead, and zinc RFC is making contracts for increasing the output from high-cost mines. The price promised includes a bonus well above normal price ceilings. Comparable contracts for increasing chemical output, where high cost manufacture is involved, can be arranged for many commodities whenever this represents the simplest and quickest way to get increased production for many products which are now scarce.

Salvage Campaign—Each company is urged to designate competent staff persons to arrange for immediate salvage of scarce materials at every factory. Where small quantities of iron and steel or other metals can be collected, this scrap should be sold to local junk dealers. This puts it promptly into the channels for reclaiming. Where unusual scrap or recovered materials are collected, these should be so handled as to insure separate classification by those who know how to salvage the special values. Campaigns should provide for collecting of rubber, burlap, and other scarce nonmetallic commodities as much as for metals. Unused properties and idle equipment should be surveyed to determine whether it would not serve best if turned into scrap. Every pound

of metal so saved is just as good as capacity to produce a pound in new form.

Build Coal Pile!—Shortage of transportation is anticipated as an inevitable consequence of troop and war goods movement. Each management is therefore being urged by Washington to build a larger-than-normal fuel pile. Thus temporary breaks in the routine of coal delivery will not cause the serious difficulty which might otherwise develop. This stock pile building during the coming summer will be particularly important in all areas remote from primary supplies.

CHEMICAL INDUSTRY AIDS IN SALE OF DEFENSE BONDS

The chemical industry of Greater New York is being organized for the Pay Roll Allotment Plan of the Defense Savings Bond Campaign. The general campaign is under the direction of Lewis E. Douglas of the Mutual Life Insurance Co. J. E. Crane of the Standard Oil Co. is chairman of the industry committee and P. M. Dinkins of American Cynamid & Chemical Corp. heads up the chemical committee. Members of the chemical committee are J. J. Butler, West Virginia Pulp & Paper Co., Earl Demmon, Stauffer Chemical Co., Fred Koch, Dow Chemical Co., C. L. Gabriel, Commercial Solvents Corp., W. I. Galliher, Pittsburgh Plate Glass Co., Lester Gordon, Solvay Sales Co., George Handel, Cincinnati Chemical Works, Glenn Haskell, U. S. Industrial Chemicals, Inc., J. H. Karrh, Victor Chemical Works, R. J. Quinn, Mathieson Alkali Works, J. P. Remensnyder, Heyden Chemical Co., Ira Vandewater, R. W. Greeff & Co., W. J. Weed, Niagara Alkali Co., and V. E. Williams, Monsanto Chemical Co.

NEW YORK SAFETY COUNCIL TO HOLD FOUR-DAY SESSION

Hazards in the manufacture of war material that result in costly delays and bottlenecks in production will be high-lighted throughout the four-day annual Safety Convention and Exposition of the Greater New York Safety Council, March 3 to 6, at the Pennsylvania Hotel. "Production for Victory", is the timely theme of the gathering.

"Tens of thousands of 'green hands' are now employed in the expanding war effort program and many more thousands are working without sufficient training on machines and with tools with which they are not thoroughly experienced", Howard P. Wall, chairman of the convention's executive committee pointed out in explaining the urgent problem of industrial hazards during the emergency.

Sessions on training foremen, mechanics and new employees will dramatize the importance of safety in manufacturing plants. Leaders and participants in these sessions will include outstanding industrialists, government officials and safety engineers. Safety demonstrations will illustrate both routine accidents and methods of handling factory fires, explosions, and other unforeseen catastophes.

Because of the wide scope of the program, 48 sessions will be held during the four days to give everyone an opportunity to attend those meetings in which he has a particular interest. Several general sessions are planned to present important overall phases of today's safety problem.

TWELFTH PACKAGING CONFERENCE WILL BE HELD IN APRIL

The most urgent of packaging problems—that of efficiently utilizing existing materials and developing substitutes for restricted materials—will be authoritatively and exhaustively examined at the Twelfth Packaging Conference, to be held at the Hotel Astor, New York, April 14-17. As in the past the American Management Association will sponsor the Conference.

At the Packaging Exposition, held concurrently with the Conference, the most recent advances in substitute materials and in techniques for packaging, packing and shipping, will be presented by suppliers of equipment, materials and machinery.

"The Packaging Conference and Exposition", it was stated by the American Management Association, "annually brings together, in one place and at one time, many thousands of users and suppliers of materials and machinery for packaging, packing and shipping. This year, all these men and companies find themselves confronted with an acute, unprecedented problem. Shortages of basic materials and the quest for substitutes are problems now familiar to all industries. In the case of packaging, packing and shipping, there is the peculiarly distinguishing consideration that the problem here has a direct influence on virtually every industry in the country, inasmuch as they are basic requirements of product distribution."

MATHIESON ALKALI CELEBRATES FIFTIETH ANNIVERSARY

The Mathieson Alkali Works, Inc., producer of industrial chemicals, is observing its 50th Anniversary. Incorporated in 1892 in Virginia, this company was the first to manufacture bleaching powder in this country and pioneered in the production and marketing of alkalies, synthetic ammonia and chlorine products.

With plants in Saltville, Va., Niagara Falls, N. Y., and Lake Charles, La., Mathieson is one of the major producers of alkalies, chlorine, synthetic ammonia, and numerous other products. At present, all three plants have been geared to maximum production to supply chemicals vitally necessary to our all-out war effort, and, recently, by arrangement with the government, the company has undertaken to produce metallic magnesium.

Half a century ago, all of the bleaching powder and most of the alkali consumed in this country were still imported from England, and the prejudice in favor of the imported products was strong. To insure a product equally as good, construction and initial operation of the new company's plant were entrusted to a retired English alkali manufacturer, Neil Mathieson. He sent a son, Thomas T. Mathieson, to this country, and under the latter's supervision the original plant was built at Saltville, Va.

SCHERING CORP. EXECUTIVES BARRED FROM COMPANY

On Jan. 29, the Treasury Department suspended eight members of the Schering Corp., of Bloomfield, N. J. from further participation in the activities of the corporation and later warned them to keep away from the plant and from contact with the employees. Among these suspended were Dr. Julius Weltzein, president of the corporation, Ernst Hammer, promotion manager, Hans Erdmann, director of engineering and maintenance, and Martin Bernhardt, comptroller and head of the legal department.

CHEMICAL SALESMEN INSTALL C. O. LIND AS PRESIDENT

Carl O. Lind, of the Dow Chemical Co., was installed as president of the Salesmen's Association of the American Chemical Industry, at a meeting in the Chemists' Club, New York, Jan. 27. He succeeds Walter Merrill, of Joseph Turner & Co., Ridgefield, N. J., who was presented with a bronze plaque in recognition of his service.

Other officers of the association are vice-president Gerald Furman, of Merck & Co.; treasurer, Phil LoBue, of the Michigan Chemical Co., and secretary, Frank Fanning, of M. L. Mahlstrom & Co. New members on the executive committee are Jack Butler, of the Industrial Chemical Sales Division of the West Virginia Pulp & Paper Co., and Jack Remensnyder, of the Heyden Chemical Corp. George Bode, of the R & H chemicals department of E. I. duPont de Nemours & Co., was presented with a traveling bag, as an appreciation of his work on the executive committee.

GAS MANUFACTURERS ELECT C. W. DUNLOP PRESIDENT

The Compressed Gas Manufacturers' Association held their twenty-ninth annual meeting at the Waldorf-Astoria, New York on Jan. 26-27. At the close of the two-day session, the annual reception and banquet was held. Officers for the ensuing year were elected as follows: C. W. Dunlop, Pintsch Compressing Corp., New Haven, Conn., president; H. Emerson Thomas, Phillips Petroleum Co., vice-president; Thomas Coyle, E. I. duPont de Nemours & Co., second vice-president; and F. R. Fetherston was reelected secretary and treasurer.

CURTAILMENT OF IMPORTS FROM THE FAR EAST SPURS DEVELOPMENT OF SUBSTITUTES IN GREAT BRITAIN

Special Correspondence

JAPAN'S entry into the war had two main effects on the British chemical trade: a further curtailment of export business, not only with East Asia but with Australia and other British overseas countries, and a rise in prices of certain drugs and oils due to the expectation of a complete stoppage of supplies. Camphor, menthol, benzoin, dragon's blood, peppermint oil, agar-agar and other products have reacted sharply to the news from the Far East. None of these articles is really essential, at least not in large quantities, for British industry, but there is no doubt that loss of these imports will tend to support the development of substitutes which is now already one of the major parts of chemical research.

A few examples may illustrate the diversity of application of substitutes in the British chemical trades. At the outset it should be made clear that not all of them are "ersatz" of inferior quality. Some indeed have proved themselves fully equal and will be found valuable long after the war. Ceramic ware fired in kilns at temperatures of 1250° and more are offered as a substitute for metals, alloys, glass and rubber. Comparable with gray cast iron in mechanical strength, they resist rust and contamination, all corrosion chemicals except hydrofluoric acid and hot strong caustic alkalis and are produced in many new shapes and sizes.

Difficulties in the supply of oils, fats and greases from overseas have drawn attention to the possibility of obtaining substitutes from domestic raw materials which were wasted before the war. Wool grease accumulating as a byproduct in the Yorkshire woollen industry is the raw material of a number of new proprietary articles which include, according to the manufacturer's announcement, crude soap ribbon with special properties, a unique unsaponifiable drying oil, purified anhydrous powdered soap, a valuable new type of oil-paint vehicle, and a fusible semi-mastic compound. Neutralised wool grease which is available in three types for solvent solution, cold or hot direct application respectively is recommended as being, in association with lanoline, unrivalled for the preservation of steel. Use of other wool grease derivatives is suggested for cutting oils, camouflage (wool grease emulsion) paints, water paints for internal decorations, waterproofed sheeting, mustard gasproof sheeting, decontamination soaps, mastic floor covering compositions and rust-preventive greases and solutions.

Plastics spray-coated with metals, in particular zinc, have been examined as a substitute for non-ferrous metals in many construction parts. The mechanical properties of the plastic-metal complex can be varied within certain limits by changes in the thickness of the metal coating. With regard to manufacturing costs it is claimed that plastic molding is cheaper in mass production than pressure die-casting. As compared with gravity die-casting or sand-casting, it is more economical in the subsequent finishing operations. It is further claimed that in electrical screening the bulk of the metal plays an insignificant part only, as eddy and high-frequency currents tend to concentrate at the surface of a metallic mass. Any metal, including copper, aluminum, tin or brass, may be applied by spraying. It has been found that plastic cable sheathing can be screened very effectively by metal-spraying and yet reasonable flexibility be maintained by suitable adjustment of conditions.

In the rubber industry experiments for the saving of zinc oxide have led to the development of a mixture of 6.25 parts of zinc oxide, 94 parts of clay and 33 parts of blanc fixe (per 100 parts of rubber) which will give satisfactory results instead of zinc oxide. Previous experiments had been carried out with 12.5 parts of zinc oxide and a correspondingly lower addition of blanc fixe, but it was found that the contents of zinc oxide can be reduced to the minimum amount necessary for the activation of the accelerators. Other wartime rubber chemicals include anhydrous calcium sulphate which is offered instead of barytes, china clay and whiting, and a precipitated silica treated with a magnesium salt which as a reinforcing filler can take the place of zinc oxide, magnesium carbonate and colloidal clays.

Two of the three main investigations carried out by the British Coal Utilisation Research Association during the past two years have also a close connection with substitution. The first was the development of a portable gas producer to replace petrol on the road. The second was to find a suitable gas fuel which could be produced in large quantities from coals available throughout Great Britain. Fuels which do not make excessive demands on skill and care of the driver are now produced in large quantities from coals available in three-quarters of the coal producing districts of England, Scotland and Wales, but the C.U.R.A. does not give any details about them. The Association has also been engaged in the development of a stove for heating public air raid shelters which eliminates the danger of carbon monoxide poisoning. Nearly 70,000 of these stoves were sold for public air raid shelters in addition to many thousands for use in government factories and private shelters.

The textile industry's demands for dyestuffs and chemicals are to an in-

creasing extent influenced by its customers' insistence on fabrics which will withstand intensive wear. Sulphur dyestuffs have played an important part in the dyeing of equipment for the armed forces, both for cotton yarns and pieces and for many cloths composed of wool and cotton. Special Service requirements include in some cases a high degree of water resistance and for certain equipment, resistance to treatment with hydrogen peroxide and citric acid. The fastness to light and washing is improved by after-treatment of fibers dyed with sulphur colors by the copper-bichrome process. Raw stock dyeing is useful for the production of cotton yarns and webbing for purposes where a great deal of abrasion will be experienced.

Limitation of fertilizer supplies is one of the factors which will make a further extension of the arable acreage in Great Britain impossible after the end of this year when it will be about 50 percent larger than before the war. In the agricultural districts of Norfolk and East Suffolk the county war agricultural executive committees have been authorised to control the rationing and distribution of fertilizers, and if this "regionalization" proves satisfactory, it will be extended to other parts of the country. At present only supplies of sulphate of ammonia are plentiful, even though in this field producers are still kept busy with deliveries of the heavy tonnages sold at rebates several months ago. The invitation to farmers to place fertilizer orders earlier this year has been so successful that producers of other chemical manures are also inundated with orders. Potash salts are distributed in accordance with the control scheme which limits supplies to certain quantities for specified crops. The demand for nitro-chalk and nitrate of soda has also outrun supplies. Production of agricultural lime has been substantially expanded, but little of it will remain at the end of the consuming season. A substantial accumulation on order books is reported for basic slag and the position of superphosphates is tight with little prospect of an early improvement.

Chemical fertilizers are, of course, one of the groups of chemical products where British consumers have been helped materially by supplies from the United States. Lease-Lend aid does not perhaps play so large a part in the chemical trades as in some other industries, but there is no doubt that there is great opportunity for an extension of British-American cooperation in the field of chemical manufacture. The leading firms on the British side generally have their private links with industry in the United States, but it is felt that the control authorities could with advantage intensify cooperation. It has been noted that the "bottlenecks" in chemical production of the two countries are not always the same, and while it may be difficult to adjust the chemical industries to each other's requirements, there cannot be any doubt that an exchange of knowledge and experience can help greatly.

GERMAN INDUSTRIES HANDICAPPED BY RAW MATERIAL SHORTAGE AND LACK OF EQUIPMENT REPLACEMENTS

Special Correspondence

EDITOR'S NOTE: *Cut off from direct correspondence with all except a few foreign sources in neutral countries, these notes interpret recent developments in continental Europe as reported in a wide range of publications and official documents received in the United States prior to our declaration of war. These monthly letters, prepared in this country, will be continued only so long as pertinent material of interest to American chemical industry is available for our comment and interpretation.*

SINCE Far Eastern supplies of important raw materials have been virtually unavailable to the Reich for two or more years, readjustments to alternate sources of supply or substitutes have been in progress. Chief products coming from British Malaya, Netherlands East Indies, the Philippines, China, and India have been rubber, tin, antimony, tungsten, coconut and tung oils, tea, fibers as Manila hemp and jute, and medicinal raw materials such as quinine.

In the case of natural rubber there has been no nearer source for Germany than British Malaya, Netherlands East Indies, Ceylon, or Thailand, since South American and African output were insufficient. Nor have any attempts been reported to raise guayule or kok-saghyz in the Reich, probably because climate and space have not permitted. For a little less than ten years Germany has concentrated on production of synthetic rubber, chiefly of the Buna type, although other kinds are produced, and to cutting down civilian use. Because of high capital investment and high production costs, capacity has not expanded much beyond an estimated 60,000 tons of Buna. This comes closer to supplying needs than might be expected, for the number of automobiles, and hence the need for tires, even in peacetime is only a fraction of that of the United States.

When synthetic rubber production was started, government decrees required increasing admixtures of Buna with natural rubber until many products are now completely synthetic. To subsidize manufacturers, revenues on natural rubber imports were turned over for a time directly to synthetic rubber producers. Synthetic rubber production has been supervised by the chemical industry, but has been partly financed by the automobile industry.

An interesting sidelight on the changeover from natural to synthetic rubber has been the marked improvement in machinery and equipment used. The latest improvement is stated to be in a mixing mill for Buna, specially constructed for dustless charging with chemicals and fillers. New centrifugal dissolution machines for mixing chemicals with latex and for handling rubber solutions as well as new types of speedier, space-saving impregnating and rubberizing machines.

For tin, the Reich depended chiefly on British Malaya, Netherlands Indies, Bolivia, China, Nigeria, and Belgian Congo in the order named. Since most of these sources were written off the books when Nazi war plans were first made, a readjustment has been underway for at least five years. Most of the tin used went into plating sheets for packing foodstuffs, lesser amounts into tin foil and distillery pipes, and some was used for bronze and bearing metal alloys and type metal. Metal food containers are now made entirely of black sheet iron or aluminum, and are reported to be unsatisfactory in many respects. Tin-foil used for all but special commercial packaging was discontinued around 1936, and collapsible plastic tubes and containers were substituted for metal containers wherever possible. Distillery pipes as well as containers have been made of glass as much as possible. To build up reserve supplies, used tubes and containers have been collected and metals recovered from municipal wastes, while some quantities were taken from stocks of occupied territory.

Experimentation with type metal to cut down or eliminate both tin and antimony is being made. Another field where tin is saved is in making soft solders, which formerly contained as high as 40 percent tin. Some new solders, according to "Chemische Fabrik," using either pure lead with an unusually sharp flux, or an alloy of lead with 6 to 8 percent cadmium, or with small amounts of zinc, copper or tin, are claimed to be just as good as former solders. Care must be exercised, however, in the careful use of solder fat when soldering copper, brass, zinc, and lead, and solders of less than 25 percent tin have not been successful for electrotechnical soldering, according to reports. In this connection it is of interest that in Italy it is claimed that a process has been developed whereby an alloy of tin, lead, and cadmium can be welded with aluminum.

Antimony, another valuable alloy, particularly for bearing and type metals, was formerly obtained mostly from China. Chinese production has dropped since 1935, but Germany has met her deficiencies partly from Slovakia and Austria, and more recently from Yugoslavia. Yugoslavia's production of antimony ore rose from 8,000 metric tons in 1937 to a record of 24,000 tons in 1940, to make her the largest continental producer. The Reich has now obtained control of Montania A. G., leading Yugoslav producer. Hungary also accounts for some antimony production but has to export its ore for smelting like Austria, which used to send its ores to Belgium. The

Thüringsche Rohstoff A. G., Weimar, Germany, obtained control of Austrian mines in 1938. Antimony is not used in Germany for manufacturing munitions as in World War I, but chiefly in automobile batteries, and in compounds in the dye industry, and as a corrosive in the rubber industry.

China and Burma have also dropped out as a source of tungsten (wolfram), needed for light globe filaments and as an alloy for high speed machine tools and magnets. Whether Japan will make supplies of such materials which the ABCD powers have not destroyed available to the Reich is questionable, and under present conditions shipment of them would be almost impossible.

Far Eastern petroleum products have never figured largely in Reich imports, but some vegetable oils were important. Lack of these supplies is one of Germany's most vulnerable points. Tung oil as a drying oil in paint and copal have long been unavailable and have caused the use of various substitutes as so-called moist oils and synthetic resins. "Talloel," a liquid resin, byproduct of the sulphate pulp industry, has been used by combining fatty acids of liquid rosin with glycerine as a linseed oil substitute. The loss of coconut oil, formerly obtained from the Philippines, has also been felt. For a while this was shipped to Germany by way of the U.S.S.R. Whale oil was substituted for a time for margarine and other products, while glycerine has been obtained increasingly from non-soap sources as sugar, molasses, and wood. Synthetic fatty acids and fillers as sodium silicate have been substituted in not too successful soaps and soapless detergents. Increasing restrictions are being placed on manufacture of soaps, candles, and other products requiring animal fats or vegetable oils.

Substitutes have been developed, although not in sufficient quantities, for sisal, manila hemp, and jute. Heavy paper bags and cardboard and wood containers are replacing sacks. "Flockenbast," a new spinning fiber made from hemp and flax straw, resulting in a fabric somewhere between cotton and linen in quality, is produced at the rate of 12 million kg. per year. It was expected that production of "cell jute" would reach 20,000 tons by the end of 1941. "Cell yarn" on a viscose basis is replacing sisal yarn and hemp for such purposes as twine and binding for harvesting. This item has been turned out since December 1940 in a remodeled factory in the Polish textile center of Lodz (now renamed Litzmannstadt).

Synthetic camphor has decreased the Reich's dependence on the Far East. The pyroxylin plastic industry has become the leading consumer of synthetic camphor. Cinchona bark for quinine has long been imported from the Netherlands Indies and manufactured in the Reich, although small amounts came from South America. Quinine salts were a big German export item before the war. Since the invasion of the Netherlands, cinchona derivatives have

been supplied directly from producing areas or have been processed elsewhere. In some cases, especially in China around Shanghai, and in Palestine, new companies producing such medicinals and other chemicals have been set up by refugees from Germany.

Growing concern over the spread of diseases caused by general undernourishment as well as by contacts of armed forces with disease-ravaged areas is reflected by the number of official decrees concerning serums and pharmaceutical preparations. Serums are constantly being called in, and manufacturers must label vaccines very carefully, especially as to what animal was used in the preparation of the vaccine. Doctors are also required to make out a certificate to each person inoculated, indicating vaccine used and what animal it came from, in order to avoid undesired secondary reactions if serum of the same animal is used for a later vaccination.

"Vitaminen und Hormonen" is the title of a new publication of the Akademische Verlags Gesellschaft. It is designed to be a central journal for coordinating results of findings on vitamines and hormones in the nutritional, physiological, and related experimental medical fields. Articles are published in German, Italian, French, and English.

"Deutsche Tropenmedizinische Zeitschrift" has been published semimonthly since the beginning of 1941 by the Archive for Ship and Tropical Medicine. Further revived interest in colonial affairs is indicated by the establishment by the Hamburg foreign and colonial forestry institute of a new division for studying byproducts of tropical forests, drugs, herbs, fragrant plants, tanning materials, oils and fats and waxes, dyes, cork, tropical fibers, and plants supplying starch and sugar.

A small but vital material normally obtainable from Africa, South America, and the Far East is industrial diamonds. The shortage in the Reich is reported to be so acute that valuable transparent gem diamonds are used since darker imperfect industrial diamonds are no longer available. The shortage is felt severely by metal working industries since harder metal alloys are being so widely used, and nothing but diamond-pointed tools will cut such metals satisfactorily, while precision instruments cannot be turned out in mass production at high speeds without the use of diamond dust grinding compounds.

To speed up commercial diamond grain production a new centrifuge (DRP 668 186) has been patented in Germany. As described in the "VDI Zeitschrift," the ground diamond powder to be separated is put into a viscous fluid such as oil, glycerine or in a salt solution. Previously when diamonds were pulverized they were allowed to precipitate in olive oil but the finest grains had to stand in the oil for a whole year, and the diamond granules varied greatly in size. The new process calls for a "mud" solution

containing as high as 20 to 30 percent diamond dust. It is placed in the beaker of the centrifuge machine. Different sized grains are centrifuged out at different speeds, thereby making it possible to separate various uniform sizes of grains. It is claimed that the process can be used in the same manner with granular boron carbide, silicon carbide, corundum, and quartz.

Another important related industrial problem in the Reich is the difficulty of undertaking normal replacements or repairs of industrial machinery. War production prevents the delivery of necessary machinery and tools so that according to a German estimate 5,000 million RM of needed replacements have had to be postponed until the end of the war.

A READER'S COMMENTS

To the Editor of Chem. & Met.:

Sir:—The editorial "Chemical Industry in the War," in your January issue, reviews the direction of U. S. chemical activities in the first World War and contrasts the situation then and now—now, when we have greater need of the application of driving force and vision to the conversion and enlargement of our chemical industry to its maximum power for offense and defense in the foreseeably long struggle for victory.

There is one phase of the direction of planning and production in this present War which calls for consideration in view of some recently made criticisms and proposals.

The Vinson committee of the House and the Truman committee of the Senate have criticized the work and efforts of the volunteers serving, with no more than token pay, on the staff of OPM, disparaging comment being principally directed to the fact that most of these volunteers were in Washington on leave of absence and so had not severed all their business connections.

The committees reported that the dollar a year system tended toward subconscious favoritism for "big business," the favoring of companies and of methods of doing business.

The Vinson committee recommended that salaries should be paid to those now serving without compensation and that there should be a complete severance from civilian payrolls without commitment to re-employment by their former companies.

I do not think the committee's recommendations, if they are carried out, will improve planning and production, for a "salary" will not solve the problem confronting the men who are now attached to OPM and WPB or the others who have been prevented from offering their services through their inability to overcome the financial problems which have confronted them.

Take the case of an independent man —a consultant or the manager and part owner of something short of "big business." Let us assume he has made about $25,000 a year in the past, that he has two children of college age, and that he lived in 1941 on an overall expenditure of $20,000 including his Federal Taxes. In the year 1942 he will have to pay about $6,500 in Federal Income Taxes—just about the salary he could expect for a full time position with WPB. From somewhere he would have to find the funds to live in Washington and to keep his house and family going along at some reduced rate. Let us guess that he can manage to make both sets of expenses come within $12,000 a year. Where is he going to get $12,000 except through cashing in on his life insurance or spending capital which he will not be able to replace in the future years of heavy taxation?

As an aside it was a member of Congress who demanded continuance of his $10,000 a year as a Congressman after he had entered the Army.

These financial difficulties have necessarily brought about a concentration of men from "big business" in OPM and their continuance on the staff of WPB.

The Vinson committee's suggestion of a "salary," unless accompanied by some form of tax relief during Government employment, does not promise to provide the effective man power needed for our tremendous war effort. The alternative to the use of men who have proved their competence and made a place for themselves in their chosen field, would seem to be the engagement of financially independent older men incapable of carrying the load or men of mediocre attainments and equivalent salary.

The progress we must make would not have promise of full accomplishment if the making of decisions vital to our "arsenal of democracy" had to rest in the hands of any other than the most competent men to be found in or out of industry.

Mechanized war demands enormous productions of raw and fabricated metals, chemicals and fuels if victory is, as it must be, attained. The planning and arrangement of manufacture of materiel is far greater than anything we have thought of as the biggest of "big business."

Ways and means must, therefore, be found so that competent men can undertake their share of the effort without reliance on a civilian subsidy and without the constant worry of inadequate finances.

The editorial, which led me to putting my thoughts on paper, was centered on the chemical industry. The problems I have discussed are wider in their scope, for they are common to the development of an organization capable of undertaking the effective planning and fulfillment of our tremendous and vital needs.

JUNIUS

PERSONALITIES

✦ WALTER L. SAVELL has resigned his position with Mathison Alkali Works, New York, N. Y., to go into the consulting business. Mr. Savell has headquarters in New York.

✦ EDMUND D. WINGFIELD has been appointed administrative superintendent of the Freeport Sulphur Co. He joined the Freeport organization in 1933 in the operating department at Freeport, Tex. Mr. Wingfield will be stationed at the company's offices in New Orleans, operating headquarters for its sulphur mines in Louisiana and Texas. A native of Virginia and a graduate of the University of Virginia, Mr. Wingfield has served in both operating and sales departments of the company.

✦ M. H. HAERTEL has resigned as secretary of Wood Chemical Institute, Washington, D. C., to join the Distribution Unit of the Chemical Division, Office of Price Administration, Washington.

✦ ARNOLD LEROY LIPPERT of Wilmington, Del., has been appointed as consultant on dyes for the Textiles, Clothing and Equipage Branch of OPM. For the past seven years Mr. Lippert has been chemical director of Joseph Bancroft & Sons, Wilmington. Prior to that he was with the du Pont organization.

✦ WILLIAM B. LEACH has been selected to manage the magnesium plant at Austin, Tex. of the International Minerals and Chemical Corp. It is expected that he will shortly leave Niagara Falls for his new work in Texas. He has been connected with the R. & H. Division of E. I. du Pont de Nemours & Co. and for several years was in charge of the Niagara Falls plant of Mathieson Alkali Works.

✦ THOMAS MIDGLEY, JR., has been selected to receive the 31st Willard Gibbs Medal, the highest award which the Chicago Section of the American Chemical Society can bestow on a chemist. Formal presentation will be made at the meeting of the section on May 22. The Willard Gibbs Award was founded by the late William A. Converse, a member of the Chicago Section. Dr. Midgley is vice president of the Ethyl Gasoline Corp. and of Kinetics Chemicals.

✦ R. R. COLE, vice president of Monsanto Chemical Co., is transferring his activities from Anniston, Ala. to St. Louis, Mo., where the company has its headquarters.

✦ PERRY D. HELSER, former president of General Ceramics Co., New York, is now chief of magnesium allocation in the OPM organization. He has been succeeded by Mr. W. L. Schoenheimer as president.

✦ DAVID L. MCKEE of Memphis, Tenn., has been appointed consultant in the Cellulose Unit, Chemicals Branch of OPM. Mr. McKee formerly was vice president of Smith, Robson and Burkhart of Memphis, with whom he was connected for more than 20 years.

✦ JAMES S. ANDERSON is now connected with the New York district sales office of the Babcock & Wilcox Tube Co. He is a graduate of Case School of Applied Science, Class of 1932, and has been connected with Steel & Tubes Division of Republic Steel Corp.

C. F. Rassweiler

✦ C. F. RASSWEILER has been appointed a vice president by the directors of Johns-Manville Corp., according to a recent announcement of Mr. Lewis H. Brown, president. Dr. Rassweiler who joined the corporation last June as director of research will continue in charge of the company's research and development activities, which now are devoted largely to converting the full production capacity of Johns-Manville to war uses. Before joining the organization, Dr. Rassweiler was with E. I. du Pont de Nemours & Co., Inc.

✦ HERBERT H. WATJEN has joined the staff of Foster D. Snell, Inc., Brooklyn, N. Y. Mr. Watjen received a Bachelor of Arts degree from Brooklyn College and a Bachelor of Chemical Engineering from Polytechnic Institute of Brooklyn. Other recent additions to the staff are: Pat Macaluso, a graduate of the College of the City of New York; Edgar W. Goth, a graduate of Grinzing College, Vienna, and Technical University of Vienna; and Peter A. Pfeiffer of Wesleyan University.

✦ OWEN CARTER, research chemist in the organization of Procter & Gamble, Cincinnati, is on leave of absence in order to do defense research at the University of Wisconsin, Madison.

✦ R. H. HAYMAN has been advanced to the position of assistant district manager of the W. H. & L. D. Betz offices and laboratories in Chicago. Other changes in the Betz organization have taken place. A. B. Baner, a chemical engineer of many years with the organization, has been assigned to the New England territory. Howard E. Jordan is replacing Mr. Baner in the New Jersey territory. W. P. Woodward, chemical engineer, has recently been transferred from the Detroit territory to the Wichita, Kans., territory. R. C. Wardlow, chemical engineer, has been placed in charge of sales correspondence in the Philadelphia office.

✦ GUSTAVUS J. ESSELEN, has been appointed by Governor Saltonstall to be a member of the Massachusetts State Board of Registration of Professional Engineers.

✦ RAYMOND R. ROGERS has been appointed chief chemist at the Welland Chemical Works, Niagara Falls, Ont. Prior to joining the Niagara Falls organization a year ago, Mr. Rogers was on the faculty of the Electrochemical Department of Columbia University, New York.

✦ ROSS AIKEN GORTNER, chief in the division of biochemistry, University of Minnesota, will receive in 1942 the Osborne Medal presented by the American Association of Cereal Chemists to scientists who have rendered distinguished service in conducting research and training students in cereal chemistry. The medal will be presented at the annual meeting of the Association next May.

✦ BENJAMIN H. MCGAR, chief chemist and assistant research director, Chase Brass & Copper Co., Waterbury, Conn., Kenneth B. Lacy, president, Lighting Products, Inc., High Park, Ill., and Edward Thomas, patent attorney of New York and Washington, D. C., have been appointed by Cornelius Vanderbilt Whitney, president of the American Arbitration Association, to serve as impartial arbitrators in connection with any industrial or commercial disputes involving vital war material production. The new appointees join a nation-wide panel of more than 8,000 qualified and carefully selected professional, educational and business leaders in approximately 1,600 cities

in every state in the Nation. A substantial number of the members of the National Panel of Arbitrators are men of the chemical profession.

✦ HOWARD H. FAWCETT is in charge of one of the TNT laboratories in the Kankakee Ordnance Works, Elwood, Ill.

✦ FRANK LORETTA is working as a chemist at the Repauno Works of E. I. duPont de Nemours & Co., Gibbstown, N. J.

✦ ROBERT SCHMITT is chief chemist at the Barksdale Ordnance Works, Barksdale, Wis.

✦ W. W. TRYON is a supervisor in the nitrocellulose department of the Hoosier Ordnance Works, Charlestown, Ind.

✦ H. F. CONNICK is a supervisor in the smokeless powder department of the Tennessee Powder Co., Millington, Tenn.; at the same plant George Gilbert is a supervisor in the acid area and W. T. Granger is chief TNT chemist; while Ralph Hegner and R. H. Newcomer are smokeless powder chemists; Oliver C. Reighn is supervisor in the TNT department and Ralph Mackay is a special technician in the same department.

✦ BEVERLY EARL CLARK and Larry Trenholme are acid chemists in the Kankakee Ordnance Works, Elwood, Ill., and Francis Houghton is a supervisor in the TNT department of the same plant.

✦ HOUSDEN L. MARSHALL is now with the engineering and development division of the Tennessee Valley Authority, Tennessee Experimental Station, Knoxville. Mr. Marshall recently transferred to Knoxville from Washington, D. C.

✦ SAMUEL B. DETWILER, JR., who was at the Soybean Laboratory at Urbana, Ill. for five years, has been transferred to Washington, D. C. Before going to Urbana, he had been at the National Bureau of Standards at Washington for ten years.

✦ WILLIAM A. ENDERSON, a 1940 graduate of the Missouri School of Mines, is now with Shell Oil Co. at Houston, Texas.

✦ ROBERT ROWAN, JR. has resigned from the staff of the Texas Technological College, Lubbock, to accept a position with Standard Oil Co. of La., Baton Rouge, La. Dr. Rowan is a graduate of Canyon State Teachers College, Canyon, Tex. and the University of Illinois, Urbana.

✦ GERALD L. GLESPEN, formerly of the Barrett Co., New York, and an active member of the Junior Chemical Engineers of that city, is now located with Hercules Powder Co., Kenvil, N. J. Mr. Glespen received his degree

in chemical engineering from the Newark College of Engineering in 1936.

✦ J. HARRY JACKSON has been appointed a research engineer on the technical staff of the Battelle Memorial Institute and has been assigned to research in metallurgy. A graduate of Rensselaer Polytechnic Institute, Mr. Jackson was associated with the Caterpillar Tractor Co. as metallurgist and welding engineer for five years prior to joining the Battelle staff.

✦ JAMES Q. KNOBLOCH is an ammunition inspector at the Radford Ordnance Works, Radford, Va.

✦ THEODORE SWANN, president of Swann and Co., Birmingham, Ala., manufacturers of synthetic menthol, camphor and other chemicals, is chief of the Birmingham Ordnance District.

IN THE ARMED FORCES

✦ GEORGE L. PARKHURST of the Standard Oil Co. of Indiana, Chicago, Ill., has been called into active duty as major in the Chemical Warfare Service.

✦ MAURICE E. BARKER, is a lieutenant colonel in the Chemical Warfare Service and is stationed at Washington, D. C.

✦ MARTIN B. CHITTICK, formerly manager of specialty sales for the Pure Oil Co., Chicago, Ill., is now a lieutenant colonel in the Chemical Warfare Service.

✦ JAMES J. MAGINNIS, formerly of Sucro-Blanc, Inc., New York, is now stationed with the U. S. Air Corps in Alabama. Mr. Maginnis received his chemical engineering degree from Brooklyn Polytechnic Institute in 1938.

✦ RAYMOND P. DEVOLUY, chemical engineer formerly connected with the American Cyanamid Co., New York, is now Ensign, U. S. Navy Materials Laboratory, Bureau of Ships, New York Navy Yard, New York.

✦ RICHARD PRIMROSE, who was recently connected with Colgate-Palmolive-Peet, is now a lieutenant at Camp Forrest, Ala. Mr. Primrose took his chemical engineering work at New York University, obtaining his degree in 1937.

✦ CASMIR L. BIGES is an ensign with the U. S. Navy and is stationed at Washington. Mr. Biges received his degree from the chemical engineering department of the Illinois Institute of Technology in 1940.

✦ S. P. TUFTS, plant metallurgist for American Smelting & Refining Co., Salt Lake City, Utah, is now a lieutenant colonel in the field artillery at St. Luis Obispo, Calif.

✦ FRANKLIN R. NORTON, formerly re-

search metallurgist with Revere Copper & Brass Co., Rome, N. Y., is now 2nd lieutenant in the Ordnance Department and stationed at Tampa, Fla.

✦ RICHARD W. REAVES, formerly chemist for Logan & Long, Co., Fulton, N. Y., is now sergeant in Company D, 4th Ordnance Training Battalion, Aberdeen Proving Ground, Aberdeen, Md.

✦ H. MELVIN ANDERSON, formerly chemist with the Aluminum Research Co. at Creighton, Pa., is now a lieutenant in the U. S. Army.

✦ S. B. TERRY, formerly of Pratt & Whitney Mfg. Co., West Hartford, Conn., is a major in the Army Ordnance Department and is stationed at Washington, D. C.

✦ CLARENCE J. BAIN, formerly at the Picatinny Arsenal, Dover, N. J., is now a major in the Ordnance Department, at Washington, D. C.

✦ EDWARD J. BARTA, formerly assistant professor of chemical engineering at the University of Cincinnati, is now a captain in the Chemical Warfare Service, Armored Force Board, Fort Knox, Ky.

✦ ALBERT CORT CAMPBELL, formerly assistant chemist for Mundet Cork Corp., Brooklyn, N. Y., is now a lieutenant in the 104th Engineers, 44th Division, Fort Dix, N. J.

✦ WILLIAM F. CHAMBERLAIN, formerly chemical engineer for Pan American Refining Corp., Texas City, Tex., is now captain in the 77th Field Artillery, Fort D. A. Russell, Marfa, Texas.

✦ GILBERT L. COX, formerly on technical service work of the Development and Research Division of The International Nickel Co., Inc., New York, and a graduate of Virginia Polytechnic Institute's chemical engineering department, is a major in the Ordnance Department. He is stationed at Watertown Arsenal, Watertown, Mass.

✦ ROBERT E. HURLEY, is a 1st lieutenant in the Ordnance Department. He is stationed at Aberdeen, Md.

✦ GEORGE R. KILLAM, is a 2nd lieutenant Assistant to Chief of Procurement in the Birmingham Ordnance District, U. S. Army, Birmingham, Ala.

✦ R. S. OWENS, formerly carrying on private practice, specializing in protective coatings, at Brooklyn, N. Y., is now a captain in the U. S. Army Ordnance Department. He is at present at the Radford Ordnance Works, Radford, Va.

✦ ROBERT D. SNOW, formerly research chemist for the Phillips Petroleum Co.,

Bartlesville, Okla., is now a major in the Chemical Warfare Service, at Edgewood Arsenal, Md.

✦ JOSEPH E. THORNTON is a 1st lieutenant in the Ordnance Department, Unit Training Center, U. S. Army Proving Ground, Illinois.

✦ ROBERT M. WEBB, formerly connected with the Bayway Refinery of the Standard Oil Co. of N. J., is now a lieutenant in the U. S. Naval Reserve. He is on active duty as Officer Assistant in Aeronautical Metals Laboratory, Naval Aircraft Factory, Philadelphia, Pa.

OBITUARY

C. D. Holley

✦ CLIFFORD DYER HOLLEY died January 16. He had been in poor health since February of last year when he suffered a severe attack of flue. Dr. Holley was born at Farmington, Maine, Sept. 2, 1878, and graduated from the University of Maine, Industrial Chemical Institute of Milwaukee, and received his Ph.D. at the University of Michigan.

He was chemist for Dr. Hand Condensed Milk Co., of Scranton, Pa., Provinsic Chemical Co., St. John, New Brunswick, and the Maine Experimental Station. He was professor of industrial chemistry at the North Dakota Agricultural College at Fargo, N. D., superintendent of Lead Products Co. at St. Louis, chemical engineer at the Gould Storage Battery Co., Depew, N. Y.

On Jan. 2, 1907, he identified himself with the Ames White Lead and Color Works, Detroit, and became chief chemist. In 1935 he was appointed director of research at the Sherwin-Williams Co. While he was employed by the Acme White Lead Works he was identified with the University of Michigan as professor of chemical engineering and head of that department.

✦ Otto S. King, vice-president and a director of Ohio Chemical and Mfg. Co., died recently in the Lenox Hill Hospital, New York, N. Y., after a four-day illness, of pneumonia and heart trouble, at the age of 65.

NEWS OF PRODUCTS AND MATERIALS

SYNTHETIC SIZING AND FINISHING AGENT

A synthetic sizing and finishing agent for textile yarns and fabrics has been announced by Rohm & Haas Co., Philadelphia. Called Rhotex size, the product is a water soluble resin and is described chemically as the sodium salt of polymerized acrylic acid. It is supplied as a concentrated paste which is easily dilutable. Designed for the replacement of natural gums in sizing work, Rhotex size is used in conjunction with a starch and also replaces a portion of the starch already employed. It is said to produce a much tougher and more flexible size and to reduce the starch's tendency toward shedding, thus resulting in more efficient weaving and better binding. This new size is also being used successfully as a modifying agent for starch in sizing spun rayon and has proved valuable in plasticizing domestic corn starches to give them the properties of the imported root starches. It has proved to be an excellent thickening and binding agent for cotton warps. In addition to sizing, this Rhotex can be used in many regular textile finishing operations and when used with starch produces a more durable finish and binds the starch more closely to the fabric. It is also being investigated in the paper field in the preparation of coated fabrics.

DEGREASER

A mineral grease and dirt digestive solvent, called Gunk X-11, has been announced by Curran Corp., Malden, Mass. The grease digestant is available in the form of a concentrate which may be diluted with a grease solvent before use to charge large open cleaning tanks or vats. The new cleaning method is carried out by cold immersion of greasy or dirty parts. The new solvent, it is said, not only takes the cling out of hard mineral dirt and grease accretion, but emulsifies them as well, so that they may be instantly and completely rinsed away by sluicing with a water hose. The removed oil and dirt disappears in the form of a milky oil-in-water emulsion which does not clog sewer drains or present a fire hazard.

The new process, it is stated, makes possible grease cleaning operations on a large scale with little investment in equipment. Only simple rectangular tanks of suitable dimensions and having an overall capacity of at least 300 gal. are necessary and many reports have been received as a result of preliminary field tests that trichlorethylene vapor degreasing tanks may be converted to the new solvent digestive and emulsifying methods by regular available shop labor.

SYNTHETIC ORGANIC CHEMICALS

N-ethyl morpholine is a colorless, water-miscible liquid boiling at 138 deg. C. This cyclic tertiary amine is potentially useful as a solvent for dyes, resins, and oils, and as an intermediate in the manufacture of dyestuffs, pharmaceuticals, rubber accelerators, and emulsifying agents. Its molecular weight is 115.17; its specific gravity at 20/20 deg. C., 0.916. These four newcomers were synthesized by Carbide & Carbon Chemical Corp., New York, and are available in research quantities.

Acetoacet-o-toludide is a fine, white granular powder which melts at 106 deg. C., and contains active methylene and carbonyl groups. It is very similar to acetoacetanilide and is also used as an intermediate in the manufacture of Hansa and benzidine pigments. It is slightly soluble in water and is soluble in dilute alkalis. Its molecular weight is 191.22.

Dimethylethanolamine (dimethylaminoethanol) is a colorless, amineodored liquid which is miscible with water and benzene. Its properties are similar to those of diethylethanolamine (diethylaminoethanol) which has been used commercially for many years. It should be useful in the synthesis of dyestuffs, textile auxiliaries, pharmaceuticals, and corrosion inhibitors. Its physical properties include: boiling point, 133 deg. C.; specific gravity at 20/20 deg. C., 0.887; equivalent weight, 89; refractive index, 1.4300.

Ethylene glycol monobenzyl ether has the high boiling point of 255.9 deg. C., and its vapor pressure is about the same as Cellosolve phenoxyglycol. It is well-suited as a high-boiling solvent in lacquers, dyestuff pastes, printing inks, and in coating compositions for paper, leather, and cloth. Its specific gravity at 20/20 deg. C. is 1.070. It is 0.4 percent soluble in water.

GREASE REMOVER

The trade name of a new material supplied in powder form for solution in water in the proportion of 2 to 12 oz. per gal. to remove oil, grease, drawing compounds and polishing materials from aluminum surfaces, is Alkalume. The solution is employed at 170 to 212 deg. F. for immersion. It does not attack the metal itself, leaves no deposit upon the cleaned surface. Packaging is in 100 and 450-lb. kegs and drums. It is a development of the Northwest Chemical Co., Detroit, Mich.

CAMOUFLAGE PAINT

Nine standard colors of camouflage paint known as Vita-Var camouflage paints have been developed by the Vita-Var Corp., Newark, N. J. These paints have superior durability and the necessary non-reflecting flat finish. They are the non-penetrating type, are easy to apply and can be used as one coat finishes on all types of surfaces.

LUMINOUS PAINTS

Another new development is the Vita-Var luminous paint which is of high

11 ways to help solve your crushing, grinding . . . and disintegrating problems

1. The Sturtevant Den and Excavator, operated by two men, is a complete unit that produces finished product in two hours time from initial mix. Product far superior to ordinary box dens, diggers, continuous processes. Low operation and maintenance costs. BULLETIN 089.

2. Sturtevant Laboratory Crushers differ from all others in many essentials. They are simply big machines made little, with even greater strength and endurance than big machines. Any number of references of highest character obtainable. BULLETIN 067.

3. Sturtevant Dustless Dry Batch Blenders automatically perfect dry batch blending no matter what the weight, sizes, densities, fineness, consistencies. Especially efficient for processing plastics and aluminum. BULLETIN 080B.

4. Sturtevant Balanced Rolls are so named because they have heavy springs back of all four bearings, and crushing shock is exactly cushioned. Goodbye to crystallizing shafts, pounded bearings, hot boxes and other troubles. BULLETIN 065.

5. Sturtevant Rotary Crushers crush or granulate to fine even sizes without producting large amounts of "fines", or dust. Even in the largest machines the product may be easily and exactly regulated. BULLETIN 063.

6. Sturtevant Swing Sledge Mills and Hinged Hammer Pulverizers quickly and economically reduce soft, moderately hard or tough fibrous substances to any degree of fineness. BULLETIN 084.

7. Sturtevant Ring-Roll Mills economically grind either hard or soft substances from 1" to 1½" size to any mesh between 6 and 200. Unique in design and operation—let us send you details. BULLETIN 079.

8. Sturtevant Jaw Crushers are made in many types and sizes for various requirements, from laboratory size to 12"x26". Small double cams develop incredible force without any noise or jar whatsoever. BULLETIN 062.

9. Investigate the improved Sturtevant Automatic Coal Crusher and Sampler Revolutionizes coal sampling! Eliminates tedious hand operations. BULLETIN 85.

10. Sturtevant Moto-Vibro Screens develop exactly the right kind of durable, classified and correctly distributed vibration that give maximum screen efficiency to every square inch of screen surface. Truly the last word in screen practice. BULLETIN 077.

11. Sturtevant Whirlwind Centrifugal Separators needs no description here—see the display advertisement on this page and judge for yourself.

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Sturtevant Air Separators are for removing fine (dust) particles from materials milled or in their natural fine state. In "Closed-Circuit" Grinding the air separator becomes an important and integral part of the pulverizing system and the governing factor of the finished product.

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intensity and is both fluorescent and phosphorescent. It can be used with blackout installations or as markers for strategic points in homes, industrial plants, public buildings, air-raid entrances, etc., as safety or economy measures in case of lighting failures and blackouts.

CAMOUFLAGE PAINT

Low visibility paint possessing exceptional heat deflecting qualities, has been developed by the Arco Co., Cleveland, for use in the protective concealment of vital defense structures and equipment. Already in use on certain government properties, the new paint meets tentative Navy specifications for infra-red reflecting paints for use on fuel storage tanks, buildings, and certain types of equipment where dark colors as well as heat reflecting qualities are required. It is now offered commercially under the trade name of Infray and is being manufactured in green, tan, black and four intermediate shades, which when properly selected will meet the requirements of good camouflage in any sort of terrain. All seven shades are hard to see from the air and throw off most of the heat of the sun's rays that would normally be absorbed. The unusual degree of heat reflection which can be obtained with the darker colors in these paints promises to be of particular value to oil refineries and chemical manufacturers with large quantities of volatile solvents in tankage above ground.

DEODORIZED PAINT

Paint designed for use in plants and offices where odors from conventional paints are offensive to workers has been announced by American Marietta Co., Chicago. Not perfumed, but actually deodorized, before being canned, it makes possible painting in winter or summer without discomfort. Windows may be kept closed while the paint is being applied. The product sets in three hours and is completely dry in 12 to 15 hours. Designated Valdura No-Odor paint, it may be used on plaster, wallboard, wood, cement, brick or metal, and is available in flat, egg-shell and gloss finishes. Coverage is 700 sq.ft. to the gal., with hiding power that makes possible one-coat jobs in many applications; of heavy consistency, ease of brushing speeds, application 10 to 25 percent above conventional wall paints. It may be applied with a spray gun when cut with one pint of the proper thinner to one gallon of paint. Flat and egg-shell finishes may be stippled. All finishes are washable, and colors are designed not to fade or dull with repeated washings. High reflectivity reduces light requirements. Colors available are white, cream, ivory, buff, grey, blue and green. Valdura No-Odor paint is not a premium-priced product, but is offered at a price comparable to conventional wall paints.

BLACKOUT PAINTS

Industrial plant windows and skylights may be covered with a new blackout coating that meets all the authoritative specifications and recommended practices, and features easy removal when danger no longer exists. Known as Carbozite Standard Black-out Black, this coating is not a paint but a smooth flowing liquid coating, manufactured from a pyrobitumen ore especially refined and mixed with quick drying volatile solvents, and a secret ingredient which provides complete opacity and an absolutely gloss-free surface. This material can be sprayed or brushed on quickly. Only one coat is required to assure complete protection against light penetration, and drying is completed in 6 to 8 hours, leaving a dead black, gloss-free coating that is as nearly totally non-reflective as is possible to obtain. From the standpoint of durability one coat of blackout black will undoubtedly outlast the war itself, and it is completely resistant to all corrosive atmospheres and liquids. This material is produced by the Carbozite Corp. of Pittsburgh. Black-out-Black 6 or 8 hours after application will not sag, peal, chip or check, at temperatures ranging from —40 deg. F. to 450 deg. F. It is easily applied to glass and gives a close bond and uniform adherence which assures of one coat being sufficient. Application of the coating is so easy that any available workman could apply it rapidly.

A blackout paint that meets all requirements for ease of application, obscuring of light and reflections, simplicity of removal and economy has been announced by the Midland Paint and Varnish Co. of Cleveland. This new formula known as Midland P-40 Blackout Paint has been made for outside application. The inside painting of glass is not recommended since light reflections and halations would still be visible even for long distances. Midland P-40 Blackout Paint dries rapidly, (30 to 40 minutes) to a self-leveling, dull, flat surface that inhibits reflections or halations. It can be brushed on or thinned with proper solvent to spraying consistency. Average area covered 550 sq.ft. to the gallon. The manufacturers claim that this product is resistant to heat, unaffected by sun rays, summer heat or high heat from inside buildings such as heat treating plants, foundries, forges, boiler rooms, etc. Also water or moisture will not affect it. Rain, sleet, snow or exhaust steam will have no effect on the dry paint film. It may be easily removed from glass windows simply by wiping off with inexpensive solvent.

The development of a complete line of blackout and camouflage paints to meet the current war emergency has been announced by the Paint Division of Pittsburgh Plate Glass Co. The paints are designed for domestic and commercial use in areas subject to possible air raids. They obscure in-

terior illumination when applied to windows, skylights and other glazed openings. The blackout and camouflage paints have been developed in four principal colors—black, smoke gray, earth drab and neutral brick. By using the color that more nearly blends with the surrounding interior building or terrain, a partial camouflage is effected in day-time in addition to providing blackout protection during the night. In cases where a complete blackout is desired, the outside of the window is covered with one coat of blackout paint and the inside with a standard interior paint. Because of the danger of glass breakage due to absorption of sun radiation by painted glass, the following recommendations have been made. (1) The entire pane of glass should be covered. (2) Only one coat of paint should be used on the exterior. (3) A black paint gives the greatest opacity but also shows the greatest heat absorption. Whenever possible, particularly on southern exposures, more neutral colors should be used. (4) The danger of breakage is minimized when paint is applied to glass areas of four sq.ft. or less.

For plant windows in areas where blackouts have been ordered, the Sherwin-Williams Co., Cleveland, has developed a blackout paint which meets requirements of the Office of Civilian Defense and which is said to give excellent results in opacity, weather-resistance and non-reflective properties, when used on either the inside or outside of the glass. Known as S-W Blackout Black, the material is supplied in one gallon and five gallon containers and can be applied by brush as it comes from the can and by spray when reduced ⅛ with petroleum thinners. According to Sherwin-Williams' technicians, the first coat in window blackout work should be white or a light color to increase reflection of interior illumination. The finish coat of blackout paint dries to a dull finish which prevents exterior lights from reflecting on large window areas.

Another new blackout paint is known as Vita-Var blackout. It is recommended for use on windows, skylights, glass doors or any surface that is desirable to blackout. This special paint forms a tough, elastic film that will not wash off in the rain. It is a paramount coating and does not have to be renewed although it can easily be removed by a razor blade scraper or paint and varnish remover. It is not affected by atmospheric conditions or by moisture and temperature conditions inside the plant, and it is formulated with a special vehicle that resists such conditions. It not only prevents the transmission of light but it also prevents the reflection of glare from exterior sources of light. It is advisable to use this paint on the outside of windows in order to prevent reflection. This is a product of the Vita-Var Corp., Newark, N. J.

A.S.T.M. and A.S.M.E. Hold Spring Conventions in March

CHEM & MET

NEWS OF MEETINGS & CONVENTIONS

GREATER NEW YORK SAFETY COUNCIL MEETS IN MARCH

HAZARDS IN THE manufacture of war material that result in costly delays and bottlenecks in production will be high-lighted throughout the four-day annual safety convention and exposition of the Greater New York Safety Council, March 3-6, at the Pennsylvania Hotel. "Production for Victory" is the theme of the gathering. Sessions on training foremen, mechanics and new employees will dramatize the importance of safety in manufacturing plants. Participants in the sessions will include industrialists, government officials and safety engineers. Safety demonstrations will illustrate both routine accidents and methods of handling factory fires, explosives and other unforeseen catastrophes.

More than 6,000 industrialists and safety experts are expected to attend the convention and exposition. Calls for exhibit space indicate that the exposition will be the largest and most informative in the Council's 13 years. Because of the wide scope of the program, 48 sessions will be held during the period.

CIVIL ENGINEERS DISCUSS EFFECTS OF BOMBING ON STRUCTURES

THE 89TH ANNUAL meeting of the American Society of Civil Engineers was held in New York, January 21-24. At the technical session of the Structural Division, the effects of bombing on structures were discussed by a number of authorities. At the joint meeting with the Society's National Committee on Civilian Protection in Wartime, E. P. Goodrich, vice chairman of the committee presented certain aspects of the problem, while W. D. Binger, chairman, spoke on observations made in England. H. E. Wessman of New York University discussed the damage to buildings by bombing and pointed out the recommended design practice. J. I. Parcel, also of the National Committee on Civilian Protection in Wartime, gave technical information on the damage to burster slabs, shelters, and other structures.

The Sanitary Engineering Division held a symposium on dewatering, drying and incineration of sludge and in addition presented several committee reports on sewage treatment and refuse disposal.

T.A.P.P.I. HOLDS ANNUAL MEETING IN NEW YORK CITY

MEETING AT the Commodore Hotel in New York, the Technical Association of the Pulp and Paper Industry held its 27th annual meeting February 16-19. Some of the topics discussed included the application of the electron microscope by G. R. Sears, Institute of Paper Chemistry; selective removal of calcium bicarbonate from water and its benefits to kraft mills by H. W. Frazer, International Filter Co.; causticizing, reburning and settling in sulphate lime recovery by G. B. Hughey and James Withrow, Ohio State University; and kraft black liquor washing on two-stage vacuum washers, by W. H. Pitkin, Oliver-United Filters.

Lighting for plant efficiency was discussed by A. K. Gaetjens, General Electric Co.; fuels and their application by E. F. Burns, International Paper Co.; modern trends in combustion control by M. J. Boho, The Hagen Corp.; theoretical approach to the design of heat exchangers by B. F. Smith and H. A. DuBois, Kimberly-Clark Corp.; heat transfer characteristics of an indirectly heated digester by J. G. L. Caulfield, University of Maine; and the flow of pulp slurries over weirs by J. D. McNitt and R. P. Whitney, Massachusetts Institute of Technology. On Friday, February 20, at the Polytechnic Institute of Brooklyn, Professor H. Mark presided at a symposium devoted to viscosity, particle size and partical shapes.

ELECTROCHEMICAL SOCIETY TO HOLD CONVENTION IN APRIL

THE 81ST NATIONAL meeting of The Electrochemical Society will be held at Nashville, Tenn., April 15-18. Plans for the meeting are under the direction of Professor J. M. Breckenridge of Vanderbilt University. At this convention there will be one symposium on "Electric Furnace Reactions" in charge of Dr. John B. Sullivan of Battelle Memorial Institute, Columbus, Ohio, and one on "Corrosion" in charge of Dr. R. M. Burns of Bell Laboratories, New York, N. Y.

"FRONTIERS IN CHEMISTRY" PRESENTED BY WESTERN RESERVE UNIVERSITY

BEGINNING FEBRUARY 13 and continuing on successive Fridays through May 22, the Western Reserve University will present twelve of America's distinguished scientists in a series of lectures entitled "Frontiers in Chemistry." The series will be divided into two parts: the first will deal with the chemistry of large molecules, while the second will give the chemical background for engine research. The first lecture will be on "Kinetics of Polymerization, X-Ray Evidence in the Field of High Polymers" by Professor H. Mark of Brooklyn Polytechnic Institute. The next lecture will be on "Colloid Aspects of High Polymeric Chemistry, Ultra-Centrifuge Studies, etc." by E. O. Kraemer of the Biochemical Research Foundation.

Other lectures dealing broadly with

CALENDAR

MAR. 2-5	**American Society for Testing Materials, committee week and spring meeting, Cleveland, Ohio.**
MAR. 23-25	**American Society of Mechanical Engineers, spring meeting, Houston, Texas.**
APRIL 15-18	**The Electrochemical Society, spring convention, The Hermitage Hotel, Nashville, Tenn.**
APRIL 19-24	**American Ceramic Society, annual meeting, Hotel Netherland Plaza, Cincinnati, Ohio.**
APRIL 20-24	**American Chemical Society, semi-annual meeting, Memphis, Tenn.**

the chemistry of large molecules will be delivered by Professor C. S. Marvel of the University of Illinois, R. M. Fuoss of General Electric Co., Professor H. Eyring of Princeton University, and Emil Ott of Hercules Powder Co. Speakers dealing with the chemical background for engine research will include E. F. Fiock of the National Bureau of Standards, F. Rossini of the Bureau of Standards, F. C. Whitmore of Pennsylvania State College, G. von Elbe of Carnegie Institute of Technology, B. Lewis of the Bureau of Mines, and O. Beeck of Shell Development Co.

Either of the two sections of the series may be taken separately. Admission will be by tickets, but tickets will not be sold for individual lectures. Tuition will be charged at the rate of $10 for each part, which will represent one credit hour for those wishing to take examinations. Application should be made to Wilbur W. White, Western Reserve University, Cleveland.

SELECTIONS FROM CONVENTION PAPERS

CATHODIC PROTECTION OF ALUMINUM EQUIPMENT

CATHODIC PROTECTION of aluminum equipment by zinc attachments (or attachments of aluminum-zinc alloys) has been successfully applied to several different types of equipment. Such protection appears to be most successful in neutral or slightly acid solutions and will probably not be satisfactory in alkaline liquids.

A small area of zinc will often serve to protect an area of aluminum many times its size, provided no part of the aluminum surface is too far distant from the zinc. However, as long as sufficient zinc is used to give nearly complete protection, the total amount of zinc consumed is almost independent of its surface area (since the rate of free corrosion of zinc is usually small compared to that caused by galvanic action).

Because of the many factors involved, the distribution and spacing of the zinc attachments must be made on the basis of engineering judgment and past experience. In practice, spacings of zinc up to 18 in. apart have proved satisfactory and some protection by zinc has been noted over distances as great as 8-10 ft.

In one installation, aluminum alloy tubes were used in a condenser which was equipped with a steel shell. Acetic acid vapor was condensed inside the tubes and cooling water circulated in contact with the outside of the tubes. The tube interiors suffered relatively little attack, but severe corrosion of their external surfaces occurred. This was probably caused, in part at least, by galvanic action between the aluminum alloy tubes and the steel shell. After several of the tubes had perforated, the condenser was equipped with a new set of aluminum alloy tubes and two zinc strips were attached to the interior of the shell. No attack of the new tubes was evident after seven months exposure, indicating that cathodic protection was highly effective.

R. B. Mears and H. J. Fahrney, Aluminum Co. of America, New Kensington, Pa., before the American Institute of Chemical Engineers, Virginia Beach, Va., November 3-5, 1941.

• • •

"All industrial plants should participate in blackout drills until such time as they have demonstrated to the responsible local authorities that their plans for blackout are workable and satisfactory. When the tests are satisfactory, the plants having defense contracts should no longer be asked to participate. In no case should any plant having defense contracts be required to stop production."

ELECTROLYTIC CLEANING OF COLD ROLLED STEEL

ELECTROLYTIC CLEANING of oil and dirt from cold rolled strip steel is of commercial importance not only before hot tinning but also preliminary to electroplating the strip. This is of particular interest because the use of this material has expanded greatly in the last few years and because it presents problems in cleaning which have not yet been entirely solved. A substantial steel tonnage (virtually the entire production of sheet for tin plate) is cleaned electrolytically for purposes other than electroplating.

At the time of the adoption of cold rolling mills, continuous lengths of steel were being electrocleaned prior to electrogalvanizing, but as the maximum speed of the strip was rarely as high as 100 ft. per minute, little was known of high speed cleaning. Later cold reduction mills operated at 250 ft. per min., but gradually the speeds have been raised to as high as 2,000 ft. per min. It was to meet this demand for high speed cleaning that the process described herein was developed.

Strip is subjected first to jets of warm alkaline solution to sweep off the larger part of the oil. The oily solution falls into a sump in the spray chamber and is reheated. The oil partially separates in a skimming tank, from which the solution is pumped back to the spray. In some instances, a brushing operation is provided as the steel emerges from the spray.

Next the strip enters the electrolytic cleaning cell, which is about 60 ft. long, and is equipped with steel grid electrodes. The steel is usually made cathodic, with current densities of 50-100 amp. per sq.ft. to remove the thin film of oil remaining. After emerging, the steel passes through water sprays and revolving brushes to remove alkali and smut. A dip in hot water heats the strip so that it dries rapidly before

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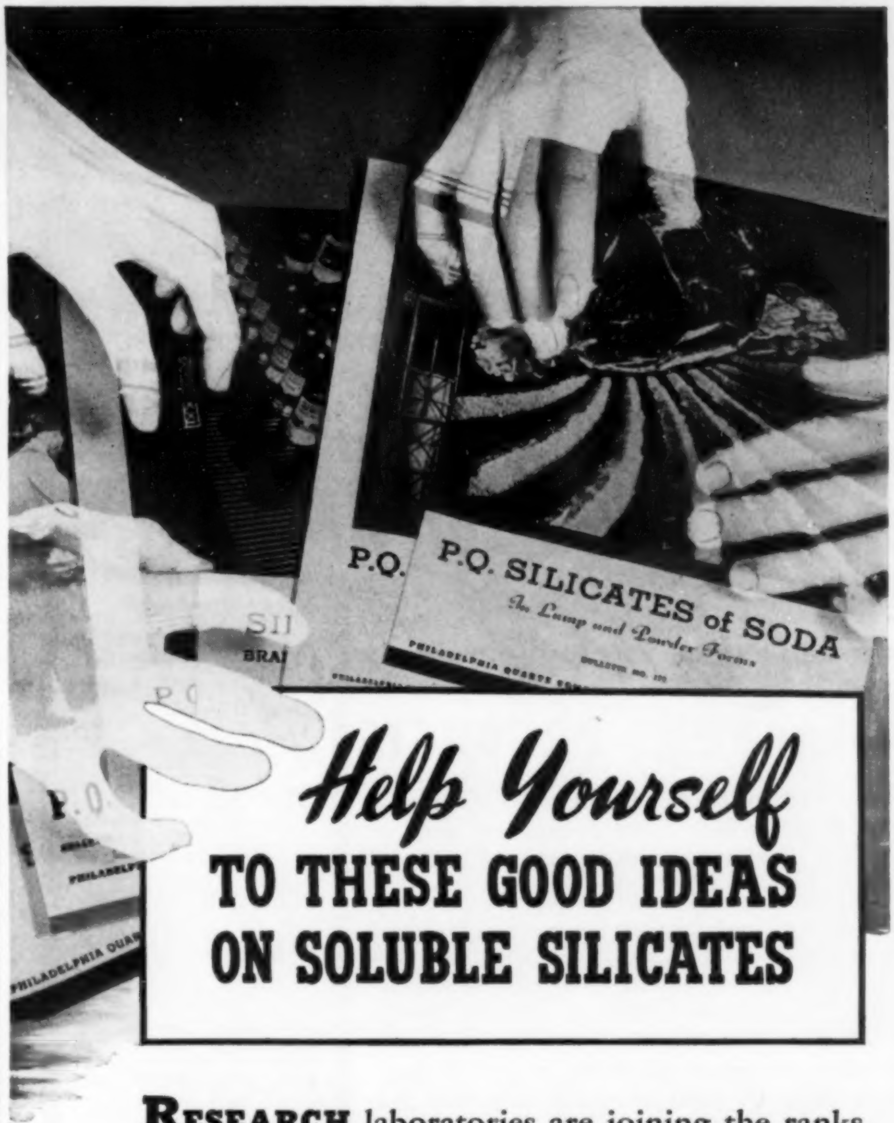

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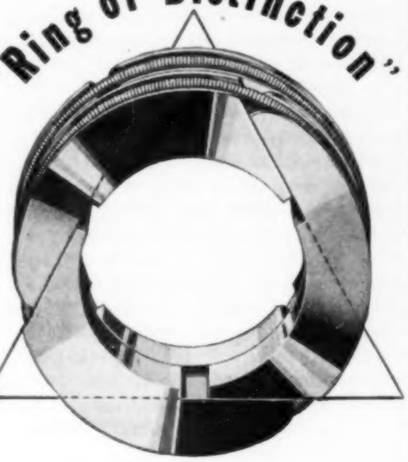

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reaching the pinch rolls and take-up reel; for extremely high speeds, a hot air blast dryer (250-350 deg. F.) is employed. The clean, dry steel is ready for annealing.

The first installation, made in 1933, operated satisfactorily at 300 ft. per min. The steel was about 15 sec. in process. With improved cleaning baths, better design and operation, modern lines operate in excess of 1,500 ft. per min., giving a treatment time of less than 3 sec. At speeds of 1,000-2,000 ft. per min., the drag-out loss tends to be high; sheets of electrolyte frequently an inch thick ride out on the strip. Rubber-covered wringer rolls and air jets keep this loss down.

Spray washers and electrolytic cells are heated by steam coils or immersion burners, with automatic controls set at 185-200 deg. F. The electrolytic cell holds about 4,000 gal. and is operated for about two weeks before being refilled. If the solution used is 4 oz. per gal. of sodium silicate, 1,000 lb. is required for charging. During the two weeks, from one to four times this amount, depending upon operating conditions, may be added for replenishment. As only 350 gal. are used in the spray washing, it is customary to drain and refill it every day or two.

During this two weeks' run, about 40 million sq.ft. or more than a square mile of steel may be cleaned. The actual surface cleaned is roughly 18,000 sq.ft. per lb. of chemicals, assuming an average figure of 3,000 lb. for replenishment in the electrocleaner. Cost of chemicals is reported to be from 2-8 cents per ton of steel.

Application of electrolytic cleaning has cut rejects of tin plate from 30-60 percent down to less than 4 percent in one mill. The generator capacity installed for this use in the United States amounts to more than 500,000 amp., exclusive of cleaning before electroplating.

Ernest H. Lyons, Jr., chemist, The Meaker Co., Chicago, Ill., before the Electrochemical Society, Chicago, Ill., October 1-4, 1941.

PILOT PLANT DEVELOPMENT OF PLIOFILM

Pliofilm, a rubber hydrochloride, is produced as a transparent sheet in thicknesses ranging from 0.0008-0.0025 in. Rubber hydrochloride suitable for castings in a transparent sheet is prepared by reacting plasticized rubber in a benzol solution with gaseous hydrogen chloride at temperatures between 5-30 deg. C. Rubber hydrochloride of about 30 percent combined chlorine gives the best results. The reaction must be stopped at this point, which is about 85 percent of the theoretical.

One of the first pilot plants for experimentation with Pliofilm was designed as a 100-gal. unit. This was

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The beverage industry at present estimates its total 190-proof ethly alcohol capacity at 60,000,000 wine gal. annually, working on a 7-day basis.

operated for more than a year, during which the characteristics of the hydrochlorination of rubber were well worked out and satisfactory control developed.

Next a 500-gal. reaction unit was designed and built to supply the small casting unit. This larger unit was tied in with the improved casting unit so that the two could operate as a small plant. The larger pilot plant functioned perfectly almost from the start. It demonstrated that the ultimate size of the unit would not introduce any operating difficulties if the proper relative capacity of the individual steps was provided for. The overall time cycle of operation was the same on a 500-gal. batch as on the 100-gal. batch.

This operation schedule was followed for almost two years on a 24-hour basis before the first large unit was built. The large unit was designed to produce 1,500 lb. daily and for some time it seemed that this figure would not be reached. However, within a year it was producing 2,000 lb. a day with no particular mechanical changes. Operating skill and technique were responsible for the achievement. Within ten years of its original conception, Pliofilm production has reached 4,500,000 lb. per year.

G. R. Lyon, superintendent in charge of Pliofilm, Goodyear Tire & Rubber Co., St. Mary's, Ohio, before the annual Chemical Engineering Homecoming, Ohio State University, Columbus, Ohio, November 15, 1941.

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High-melting coal-tar pitch in granules is especially effective in extinguishing magnesium fires, according to the U. S. Bureau of Mines.

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CORROSION IN THE COOLING SYSTEM OF POWER RECTIFIERS

CORROSIVE CONDITIONS in the cooling system of multi-anode steel tank rectifiers were serious when water was used without anti-corrosive treatment. Corrosion was the typical kind caused by differences in oxygen concentration arising from uneven distribution of dissolved air over the metallic surface. This type of corrosion was almost completely inhibited by using recirculating 0.5 percent sodium chromate solution with a heat exchanger.

Recent ignitron mercury arc rectifiers permit temperature control by passing the coolant through a helical coil of tubing. This practically eliminates the corrosion problem. However, the use of a recirculating chromate solution is usually recommended for reduction of general corrosion in the cooling system. In some localities where water may be corrosive or where scale may reduce the cooling efficiency of the tubing, a recirculating system with heat exchanger is mandatory. In this case, the use of chromate is recommended to keep the solution clean by passifying the ferrous metal in the exchanger and other parts of the cooling system.

When local water is bad, use of distilled water is recommended for making the chromate solution. Enough

alkali such as NaOH should be added to convert any dichromate to chromate and to make the water alkaline to phenolphthalein before addition of the 0.5 percent sodium chromate. Besides lowering the rate of primary corrosion, the alkali decreases the rate of chromate reduction by organic matter in the system.

H. D. Holler, research engineer, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., before the annual Chemical Engineering Homecoming, Ohio State University, Columbus, Ohio, November 15, 1941.

SEARCH FOR NEW INSECTICIDES

LEAD, ARSENIC and fluorine are toxic elements and the use of more than 100,000,000 lb. annually of arsenical preparations, mostly applied to fruits and vegetables, is of considerable concern to health authorities and the general public. Since other inorganic compounds would also leave spray residues that might be health hazards, the trend in the development of new insecticides has been toward organic compounds.

Recently a variety of tobacco in which nornicotine predominates has been receiving attention for possible commercial utilization as an insecticide. Nicotine and anabasine have been synthesized in the laboratory, but the prospects are not bright for their commercial manufacture. With the exception of neonicotine, which is of the same order of toxicity as nicotine, all the synthetic derivatives of nicotine are inferior as insecticides.

Neonicotine, obtained as one of the reaction products of sodium and pyridine, is of interest in that shortly after its synthesis it was found that the naturally occurring alkaloid, anabasine, was identical in structure with neonicotine but is optically active. Metanicotine is almost equal to nicotine in toxicity. Nornicotine differs from nicotine in that the methyl group or the nitrogen of the pyrrolidine ring has been replaced by hydrogen.

Pyrethrum flowers can be grown in almost every State in the Union, but for economic reasons most of them are imported. Until August 1940, about 90 percent of the annual imports came from Japan. Since that time, Kenya flowers have largely superseded those from Japan. Imports into the United States in 1940 amounted to 12,600,000 lb.

Minor changes in the pyrethrin structure destroy for the greater part its insecticidal properties. Both of

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Domestic requirements of tungsten in 1942 are estimated at 25,000 tons. Potential supplies include only 8,000 tons from domestic sources, 6,000 tons from South America, and not over 1,000 tons from Portugal. As a result of this shortage, tungsten is being replaced by molybdenum in about half of the steel for high-speed tools. More than 75 percent of cutting tools have been made from tungsten high-speed steel.

the tetrahydropyrethrins are relatively non-toxic to house flies. Most of the studies with derivatives and related compounds indicate that the characteristic insecticidal action of the pyrethrin lies in the molecule as a whole rather than in some component part.

In 1940 more than 6½ million lb. of derris and lonchocarpus were imported into the United States. Imports of these for 1931 amounted to only 8,400 lb. Many derivatives of rotenone and degradation products have been tested as insecticides but only dihydrorotenone, in which the double bond of the side chain has been saturated, is of the same order of toxicity as rotenone. Rotenonic acid, formed by hydrogen cleavage of the furan oxygen which usually accompanies preparation of dihydrorotenone, is relatively nontoxic.

As most materials of animal origin are not promising as insecticides and as plant extracts and derivatives have been fairly well explored, attention is now being concentrated on synthetic organic insecticides. The availability of many synthetic organic compounds for industrial use has stimulated research on these materials as insecticides and a large number of compounds unrelated to plant products have been synthesized and tested. A number of these have been found promising.

H. L. Haller, Division of Insecticide Investigations, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, Washington, D. C., before the Chemical Society of Washington, January 8, 1942.

NEW DEVELOPMENTS IN MAGNESIUM COMPOUNDS

AMONG THE NEWER magnesium developments is that of adding an active grade of magnesium oxide to mixed fertilizers to give a product which contains magnesium values in a particularly desirable form. A substantial tonnage of MgO is now used for addition to fertilizers.

By proper preparation of raw materials and heat treatment, so-called activated MgO with unique properties can be produced. These selectively absorb a variety of organic materials and they can be used for recovery of organic values from solution. By varying the heat treatment of the base materials, these absorptive characteristics can be varied widely. Although the tonnage of activated MgO being produced is relatively minor, nevertheless this field is extremely promising. The separation of carotenes from solutions was one of the early applications of active MgO. In this case, it was

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Neoprene reclaim can replace as much as 50 percent of raw neoprene and reduce by as much as 25 percent the volume cost without greatly impairing physical properties of medium or low-grade mechanical good vulcanizates. Many reclaim concerns are prepared to do neoprene reclaiming on a custom basis.

found that activity could be too great, and consequently materials of medium activity had to be developed. The use of active MgO in the dry cleaning field represents an important development.

Activated magnesium silicates having certain of the properties of active MgO have been developed very recently, and already are being widely used as absorbents in dry cleaning and in oil refineries.

Application of flotation methods to the beneficiation of crystalline magnesite ores may result in a revolution in their mining and processing. Flotation methods which give reasonably satisfactory separation of $MgCO_3$ from dolomite, calcite and magnesium silicates have been developed by the Bureau of Mines and other organizations. These schemes seem likely to make possible the production of high grade magnesias from crystalline magnesite containing large percentages of impurities that would otherwise be of little commercial use.

A modification of the old method of separating MgO from lime in calcined dolomite by solution of the lime in water has been developed on a pilot plant basis within the past few years. This scheme increases the solubility of the lime to a large extent simply by adding sugar to the treating water. Recovery of the sugar by carbonation of the calcium sucrate solution is resorted to and sugar is added only to supply process losses. So far as is known, no commercial application of this process is yet contemplated.

Another magnesia-lime separation method applied to calcined dolomite which has been studied on a pilot plant basis during the last year or so is that in which H_2S is used. This scheme, studied by the Warner Co. of Philadelphia, burns dolomite under controlled conditions, passes H_2S into an aqueous suspension of the calcined and hydrated dolomite, and settles or filters the insoluble $Mg(OH)_2$ from the solution of calcium sulphidrate. The solution is then carbonated with kiln gases to precipitate lime as $CaCO_3$ and recover H_2S to be recycled. Magnesium hydroxide, which contains all the silica, iron and aluminum present in the raw dolomite, is calcined to commercial MgO. The precipitated $CaCO_3$ can be calcined to a pure lime. It is understood that no decision has yet been reached with reference to commercial exploitation of this process.

Proposals have recently been made to recover magnesium values from the minerals olivine and serpentine. The former yields its magnesium content readily in solution to H_2SO_4, but serpentine is attacked with more difficulty. A small operation is currently turning out epsom salts from olivine near Sylva, N. C. Recently the serpentines of Georgia were publicized as possible sources of metallic magnesium. While it is feasible technically to make solutions of magnesium salts from olivine or serpentine and likewise to calcine $MgSO_4$ and produce MgO with recovery and recycling of the H_2SO_4, there

is no indication that an operation based on these principles can survive post-war competition save in a minor capacity, and then owing to geography rather than to process economics.

M. Y. Seaton, vice president and technical director, Westvaco Chlorine Products Corp., New York, before the American Institute of Mining & Metallurgical Engineers, Rolla, Mo., October 23–25, 1941.

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Small quantities of formaldehyde are now being manufactured by the oxidation of hydrocarbons from natural gas. Some 77 percent of the formaldehyde produced is estimated to go into synthetic resins for plastics, less than one percent into textiles and dyestuffs each, and a little more than one percent for embalming fluid.

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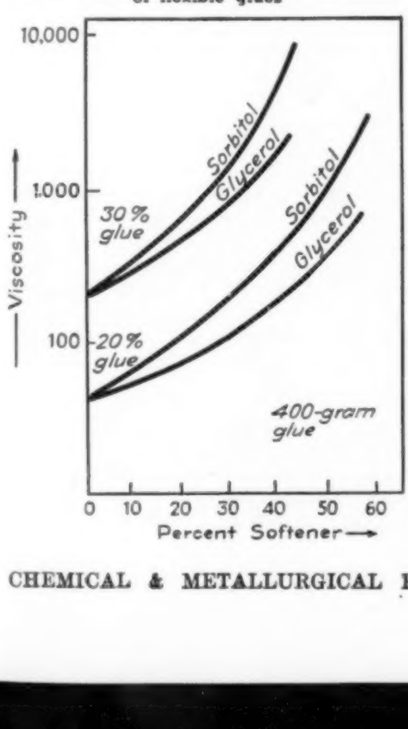
SORBITOL IN GLUE COATINGS

PRESENT MARKET conditions in the glue field offer an excellent reason for investigating glue softeners. Animal glues are high in price and are more and more difficult to obtain. It is timely, therefore, to compare sorbitol with glycerol in flexible glue formulations, with the idea that sorbitol may be substituted in a standard glue-glycerol formula with a saving in amount of glue or grade of glue used.

Straight glue-water "gels" dry out, shrink, and harden under normal humidity conditions. Such "gels" must hold a certain percentage of water to keep their full usefulness after application. Hence, a permanent flexibilizing or humectant agent is needed to stabilize the material and minimize the effect of changes in moisture content. Since the polyalcohols act not only as flexibilizers but also as "water-holders," they are logical softeners for animal glues. Unfortunately, the literature on flexible glues is meager and there is almost none discussing softening agents in glue compositions.

Sorbitol gives less flexibility in glues than glycerol, but the non-volatility of sorbitol makes its flexibilizing action permanent. In stabilizing water con-

Effects of sorbitol and glycerol on viscosity of flexible glues



tent, sorbitol is the most and glycol the least effective. Sorbitol gives greater tensile strength as well as higher viscosity than glycerol or the glycols for all grades of glue at equal concentrations of glue and softener. At high temperature and high humidity, sorbitol gives permanent protection, while at low humidity glycerol, imparting less viscosity and hence more flexibility, gives essentially permanent protection. Combinations of the two softeners are sometimes used to blend the desired flexibility characteristics. The substitution of sorbitol for glycerol in a flexible glue permits the use of less glue or sometimes even a lower grade of glue.

An example of tailor-made formulations is that of an oil-proof coating for paper and fiber containers. A thin, continuous, permanently flexible film, insoluble in oils or fats, is required. First of all, this necessitates the use of a high-grade glue. To effect permanent flexibility, a polyalcohol must be added and ethylene glycol can be eliminated because it is volatile as well as soluble in oils. Glycerol is not appreciably volatile and is insoluble in most oils and hydrocarbons, whereas sorbitol is non-volatile and insoluble in all oils and hydrocarbons.

Henry C. Speel, Atlas Powder Co., Wilmington, Del., before the Technical Association of the Pulp and Paper Industry, Ann Arbor, Mich., Sept. 18, 1941.

ROLE OF BACTERIA IN CORROSION OF IRON AND STEEL

SEVERAL TYPES of anerobic bacteria have been associated with corrosion of iron and steel pipe lines. The "sulphate-reducing" organisms reduce sulphates in water and liberate hydrogen sulphide, with formation of ferrous sulphide. The "iron-consuming" bacteria use ferrous iron in aqueous solution and exude it through their cell walls as red ferric hydroxide.

In one case, severe pitting and perforation of a 3-mile water main in the Miami Valley could not be satisfactorily explained. The line carried a comparatively slow flow during summer months. During the winter the flow was negligible, setting up a "dead end" condition. Analysis revealed the water to be non-corrosive, nor had corrosion been encountered in other localities where there was normal flow.

Sections of the pipe which began to perforate on the bottom in less than two years after installation were examined. Tubercles about 2 in. in diameter were found to be present inside the pipe on the bottom. Underneath were deep pits verging on perforations. These tubercles were found to consist chiefly of ferric hydroxide with appreciable quantities of organic matter. Examination showed the presence of iron-consuming bacteria

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A new steel nitriding process, held to be commercially promising, has been described in which synthetic urea was used in a closed container in place of ammonia.

and it was concluded that because of the slow flow, the organisms formed deposits on the bottom of the pipe. These resulted in formation of oxygen concentration cells conducive to pitting, in all likelihood accelerated by the putrefaction products of the organisms.

If chlorine is introduced so that the residual amount is in the vicinity of 0.5 p.p.m., a large proportion of the corrosion-producing bacteria will be destroyed. If it is desired to avoid the chlorine taste in the water, the chloroamine treatment is recommended. Super-chlorination may also be used. The ordinary lime-soda softening treatment apparently is satisfactory in destroying the less resistant types, but does not necessarily completely eliminate the hardier types of organisms.

Besides chemical treatment of the water, accumulation of excessive growths can be reduced (and in some cases probably eliminated) if the pipe walls are given a coating of coal-tar base enamel. Apparently the small amounts of phenol in the coating have toxic properties toward the organisms.

A. H. Thomas, chief chemist, Research Laboratories, American Rolling Mill Co., Middletown, Ohio, October 1, 1941.

TURBINES FOR POWER GENERATION FROM INDUSTRIAL PROCESS GASES

WHENEVER A continuous flow of gas is available under pressure, it is always well to consider whether an advantage can be derived from expanding the gas through an elastic fluid turbine. In general, justification for a turbine would be the power which it could produce, but an increasing number of processes are being considered in which the advantage is the reduction in gas temperature due to the energy absorbed by the turbine.

The most important development in the use of turbines driven by industrial process gases is found in connection with catalytic petroleum refining processes in which carbon is deposited on the catalyst. This must be burned off and in several of the processes it is most economical to do this under pressure, sometimes as high as 300 lb.

Maximum regeneration temperatures are controlled either by tubes through which a coolant is passed or by recirculation of some of the products of combustion through a waste heat boiler. Heat from these combustion gases could be partially recovered, but the pressure potential would be largely wasted. This pressure potential can be utilized and a large portion of the heat removed by passing the gas through a turbine.

In some cases, sulphur will be deposited on the catalyst and this will appear as SO_2 in the flue gas. In order to avoid corrosion, the rotor, buckets,

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Ammonium sulphamate has recently been developed as a weed killer to be applied merely by spraying. This material, unlike most other weed killers, is neither flammable, poisonous to animals, nor damaging to soil fertility.

nozzles and other parts of the turbine can be made of a high grade of stainless steel, with a low alloy steel for the casing parts. Valve trims can be of Stellite, interior packing of a special cast iron and outer shaft packing of carbon.

Another potential field for power from expansion of gas through turbines is the natural gas industry. Numerous small turbines of standard steam designs are being operated by natural gas and are used to drive pumps and other apparatus. However, there are undoubtedly many cases where no power is derived from expansion of the gas, but where the pressure drop from the wells to the point of use is much greater than is really needed to overcome friction losses in pipes.

In the re-pressuring process of liquid extraction from natural gas, well pressures run from 1500-3000 lb. per sq.in., while the pressure in the absorption tower is usually from 1000-1500 lb. per sq.in. Since the amount of liquid extracted increases with decreasing temperature, any power obtained by passing the gas through a turbine would contribute to the yield. The turbine could be designed to separate out a large portion of the liquid from the gas by centrifugal force and might thereby replace one or more of the extraction devices normally used. If 50 million cu.ft. of free gas per day are processed with a main pressure of 2,000 lb. per sq.in. dropping down to 1,000 lb. at the absorption tower, and if we assume a temperature of 100 deg. F. at the main and a net pressure ratio of 1.8 for the turbine after allowing for pipe losses, the net power obtainable will be about 650 hp.

Temperature of natural hydrocarbon gas from the wells is very low compared with that of combustion gases and is frequently less than 120 deg. F. When such gas is expanded through a turbine, the temperature of the outlet may be below freezing. This not only requires the use of materials which retain their ductility and strength at such low temperatures, but also introduces a possible difficulty from ice formation. If advisable, moisture, hydrates and even CO_2 can be removed

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The British have developed several practical hints for increasing the output of anodized aluminum parts by as much as 25 percent per operating hour. One of these is to alter the anodizing conditions while using the standard solution. The Bengough-Stuart method specifies 104 ± 8 deg. F. with the voltage gradually increased to 50 to give 3 amp. per sq. ft. Total treatment time is one hour. Treatment time can be reduced to less than two-thirds of standard by using 93 ± 2 deg. F. and raising the voltage to 60 in 7 minutes and maintaining it for 28-30 minutes.

Women now account for 23 percent of all labor in British chemical works. Generally speaking, three women can do the work of two men if working conditions are suitably adjusted.

from the gas before it enters the turbine. In one natural gas application where turbines were used to drive electric generators, beryllium copper was used for the trigger of the emergency overspeed governor in order to prevent sparks when the governor bolt would strike the trigger.

John Goldsbury and J. R. Henderson, Turbine Engineering Department, General Electric Co., Lynn, Mass., before the American Society of Mechanical Engineers, Louisville, Ky., October 16. 1941.

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In one pigment manufacturing process, originally requiring 25 lb. of urea and 3 hours to complete excess nitrite removal, ¼ lb. of sulphamic acid completed the reaction in approximately 5 minutes to give better results.

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THE PETROLEUM INDUSTRY IN 1941

DEMAND FOR PETROLEUM products in 1941 was by far the greatest in the 80-year history of the industry, amounting to nearly 1.6 billion bbl., almost 10 percent above 1940. United States consumption alone increased more than 12 percent. At the end of the year the industry was producing crude petroleum at a rate of more than 4.1 million bbl. per day with predictions that rapidly mounting needs would require 4.5 million per day by the middle of 1942 and possibly 5.0 million bbl. by July 1, 1943.

Capacity of American refineries to produce 100-octane aviation motor fuels increased to 44,000 bbl. daily (50,000 bbl. or 2.1 million gal. with a greater proportion of tetraethyl lead) by the end of 1941. Present plans call for quadrupling this capacity within the earliest possible time. The present capacity for this one grade of aviation fuel alone is far greater than the total capacity of the rest of world combined, and is 7½ times the U. S. consumption of all grades of aviation fuel as recently as 1938.

Production of Crude Petroleum
(In Bbls. of 42 U. S. Gal.)

Year	United States	Rest of World
1937	1,279,160,000	762,878,000
1938	1,214,355,000	753,332,000
1939	1,264,962,000	811,810,000
1940	1,353,214,000	823,548,000
1941 (est.)	1,405,218,000	809,399,000

Drilling of wells increased slightly to 31,299, second busiest drilling year in the industry's history. Of these wells, 21,984 were completed successfully as oil wells, and 2,869 as gas wells. The remaining were unsuccessful dry holes.

Total domestic and export demand for refined petroleum products were: motor fuel, 683,843,000 bbl.; distillate fuel oil, 188,513,000 bbl.; residual fuel oil, 395,527,000 bbl.; kerosene, 71,400,000 bbl.; and lubricating oil, 41,500,000 bbl. The most spectacular increase was in the domestic demand for lubricating oil, which gained nearly 30 percent over 1940.

William R. Boyd, Jr., president, American Petroleum Institute, New York, December 29, 1941.

SELECTIONS FROM FOREIGN LITERATURE

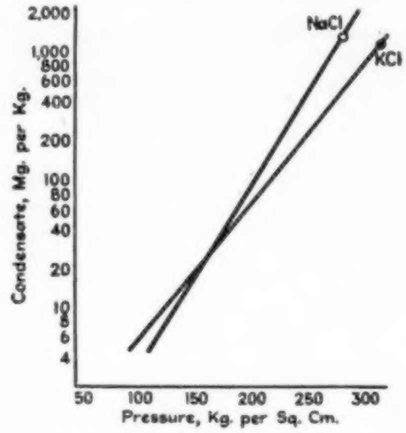
ACID OPEN HEARTH PROCESS

IN A study of deoxidizing and tapping conditions when an open hearth furnace is operated at comparatively low temperatures (about 1,375 to 1,450 deg. C. in the melt) it was found that the product [C] [O] (carbon times oxygen content) is nearer to equilibrium the higher the temperature. The oxygen content of the steel bath may be considerably increased if the temperature is low enough to prevent reduction of silica. In normal heats, if not too cool, there is no considerable content of inclusions in the steel bath prior to deoxidation. The same is true of high carbon heats after deoxidation. In low carbon heats with comparatively high oxygen content silicate inclusions are precipitated promptly after adding silicon. With respect to quality of steel it makes no difference whether additions of silicon and manganese are made successively (in either order) or as silicomanganese or as ferrosilicon and ferromanganese. Momentary localized precipitation of silica or silicates when the addition is made may be disregarded since the precipitate soon redissolves as homogeneity is restored. Tapping (exposure to air) causes a rise in nitrogen content, but oxygen is used up in oxidizing carbon and escapes as carbon monoxide. In low carbon steels there is an increase in oxygen content due to tapping, since alloying elements which form solid oxides are then oxidized instead of carbon.

Digest from "Studies on the Open Hearth Process," by Bo Kalling and Nils Rudberg, *Jernkontorets Annaler* **125**, 283-325, 1941. (Published in Sweden.)

HIGH PRESSURE STEAM AS A SOLVENT

INORGANIC compounds such as NaCl, KCl and NaOH can actually be volatilized by high pressure steam, or they may be said to be soluble in the steam. Solubilities as high as 0.124 percent by weight have been observed for NaCl in superheated steam at 407 deg. C. under a pressure of 275 kg/cm.² Steam containing salt in solution has no significant electrical conductivity. This, coupled with an earlier observation to the effect that the NaCl content of steam is largely independent of the concentration in the liquid phase, indicates that steam acts on NaCl by hydrolysis and not by dissociation. The experiments were made possible by an improved autoclave and accessory equipment permitting measure-



Solubility of potassium chloride and sodium chloride in superheated steam

ment of steam composition over aqueous solutions and solid salts at temperatures above 400 deg. C. and pressures above 300 kg/cm.² The results are important in relation to problems of salt scale in steam boilers and turbines.

Digest from "High Pressure Steam as Solvent," by Otto Fuchs, *Zeitschrift fur Elektrochemie* **47**, 101-10, 1941. (Published in Germany.)

CARBON BLACK UNDER THE ELECTRON MICROSCOPE

IN ORDER to characterize carbon blacks by their particle size several varieties were examined in an electron microscope. To obtain sufficiently fine particles the blacks were dispersed in water with the aid of ultrasonic vibrations and a dispersing agent.

Digest from "Carbon Black Studies With the Electron Microscope," by H. Heering, I. von Gizycki and Addi Kirseck, *Kautschuk* **17**, 55-62, 1941. (Published in Germany.)

PLASTICIZED RESINS

THE PROBLEM of plasticizer loss by vaporization from plasticized resins has been studied by measurements of acetophenone losses from a novolak type resin. It was found that the proportionality between vapor pressure and rate of evaporation is retained in pure acetophenone and in resin com-

Carbon black data obtained with the electron microscope

Black	Source	Particle Size (Microns) Min.	Max.	Range	Tensile Data Strength kg./cm.²	Elongation, percent	Specific Electric Resistance ohm/cm.
Thermax	Gas	0.3	0.7	1:2	80	450	10^{11}
Luv 36	Lampblack	0.1	0.4	1:4	90	500	10^{11}
P 33	Gas	0.1	0.2	1:2	100	480	10^{11}
Elastik	Oil	0.08	0.14	1:2	130	410	10^{3}
Durex I	"	0.05	0.13	1:2.5	140	440	10^{8}
Splendor 706	"	0.04	0.09	1:2.5	150	470	10^{10}
Inca	"	0.03	0.04	1:1.3	180	390	10^{3}
Ultramicronex	Gas	0.02	0.05	....	220	440	10^{5}
P-1101	Acetylene	0.03	0.04	....	200	400	10^{1}
P 1250	"	0.03	0.04	....	200	420	10^{1}
Anacarbon 41284	"	0.03	0.04	....	200	600	10^{1}
VN 500	Naphthalene	0.02	0.03	....	220	390	10^{2}
CK 3	"	0.02	0.03	....	220	410	10^{2}
Royal Spectra	Gas	0.01	....	....	...	...	....

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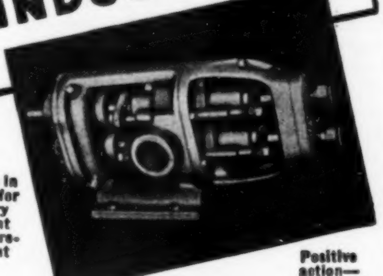

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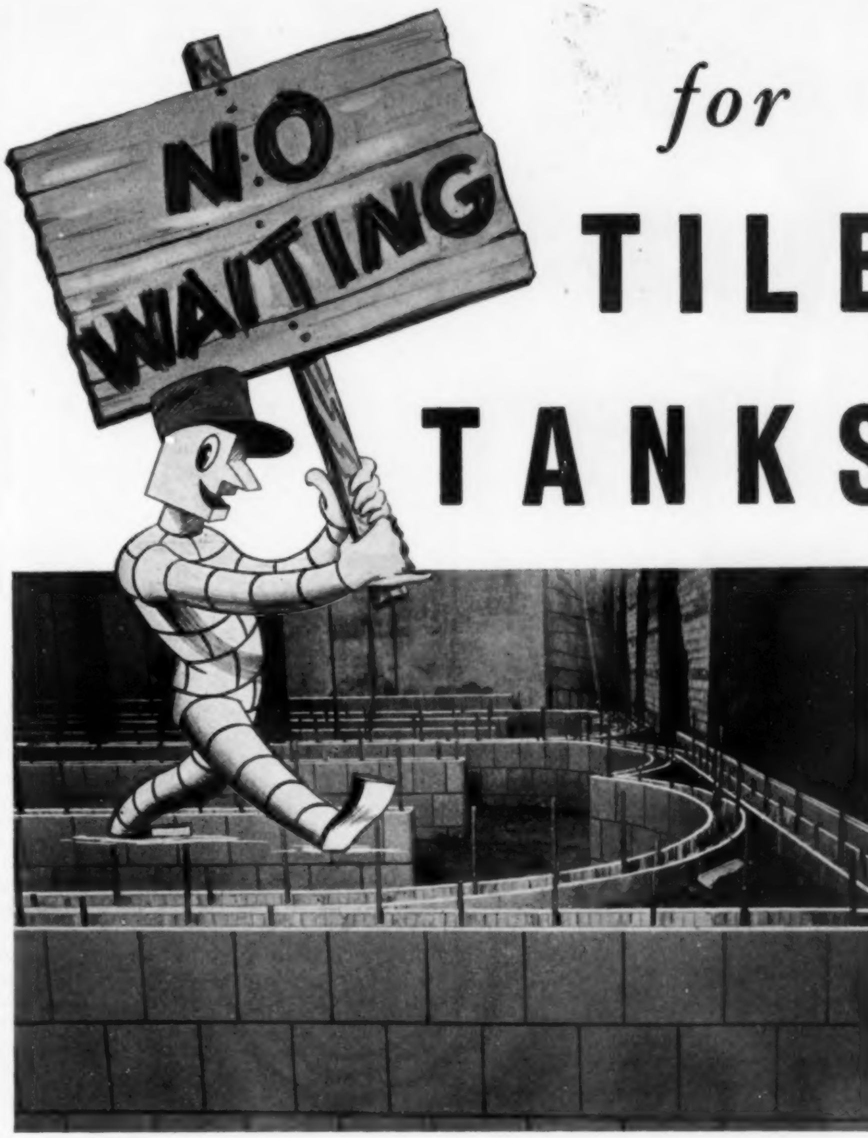

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positions containing at least 70 percent of acetophenone by weight. Presumably diffusion of the plasticizer to the surface is rapid enough to offset the slight surface impoverishment as acetophenone slowly evaporates. When the plasticizer content was 60 percent or less diffusion was too slow to maintain the proportionality of evaporation loss to vapor pressure. Surface impoverishment occurred and the plasticizer loss was smaller than the theoretical value. Measurements of diffusion coefficients in compositions with 20 to 60 percent acetophenone showed that the logarithm of the diffusion coefficient is a linear function of concentration.

Digest from "Volatility, Diffusion and Vapor Pressure in the System Acetophenone: Novolak," by E. Jenckel and J. Komor, *Zeitschrift fur Elektrochemie* **47**, 162-3, 1941. (Published in Germany.)

ADSORPTION OF ORGANIC VAPORS

TESTS with raw and desiccated decolorizing clays and with kaolin showed that bleaching earths made by desiccating raw clays at 110–120 deg. C. retain adsorbed water better than raw or desiccated kaolin. Bleaching earths were then tried as adsorbents for trichloroethylene and gasoline vapors. Raw clays adsorbed 13 to 17.2 percent by weight of trichloroethylene but the desiccated earths prepared from them adsorbed 44 to 69.5 percent by weight. Kaolin was much less effective, adsorbing only about 10 percent by weight. These tests were made with powdered bleaching earths. Adsorption of gasoline vapor was similarly tested with granulated bleaching earths in 3 grain sizes: 1.0 to 1.5 mm., 2.5 to 3 mm. and cylinders 3 x 3 mm. (formed without a binder). The highest adsorption (in weight percent) was 15.4 for the smallest grains, 18.4 for larger grains and 23.0 for cylindrical grains. These results show the utility of desiccated clays for solvent recovery by adsorption.

Digest from "Adsorption of Vapors by Decolorizing Clays and Earths," by Edward Erdheim, *Oesterreichische Chemiker-Zeitung* **44**, 104-4, 1941. (Published in Vienna.)

PULPING PINE HEARTWOOD

TROUBLES encountered in pulping pine heartwood by the sulphite process have been attributed to colloid-chemical aging or swelling processes and to the presence of organic (resin and fatty) acids. But systematic research has revealed the real trouble maker to be pinosylvin (3, 5-dihydroxystilbene). This unsaturated dihydric phenol is present in pine heartwood either as such or as the monomethyl ether, methylpinosylvin. If the acidity is allowed to rise too high in sulphite pulping the lignin, even if already partially sulphonated, is phenolated by pinosylvin or methylpinosylvin and highly condensed lignosulphonic acids are formed as solids which will not dissolve. In mildly alkaline or neutral

solution, or even in faintly acid solution, sulphonation is so much faster than phenolation that lignosulphonic acids are formed which will not react with pinosylvin or methylpinosylvin. Pulping then takes its normal course.

Digest from "Pulping Pine Heartwood by the Sulphite Process," by Erich Hägglund, *Oesterreichische Chemiker-Zeitung* **44**, 104–7, 1941. (Published in Vienna.)

RECEPTION OF INK BY PAPER

To DEVELOP a single test system applicable to all ink-receiving papers (from high absorption blotting through newsprint to hard finish writing papers) a modified float method was developed for measuring penetration velocity. Since the test is essentially a determination of absorption capacity the result is best expressed in absorption units. The chosen absorption unit is $f = F^2/100S$ where F is weight of the specimen per unit area gm. per sq. cm. and S in penetration time in minutes (the factor 100 is introduced merely to produce more convenient units). In theory the values of f range from 0 when $S = \infty$ (totally nonabsorbent paper) to ∞ when $S = 0$ (instantaneous penetration). This method is superior to previous tests which measured contact angles, height of capillary rise or other properties. It readily characterizes all grades of paper, with values of f up to 10,000, grouped somewhat as follows:

Paper	f (approx.)
Blotting	3,000-10,000
Unsized (intaglio) printing	100 to over 1,000
Sized printing	1-100
Writing	1 to over 10

Digest from "Characterizing Ink Reception by Paper," by W. Brecht and E. Liebert, *Papier-Fabrikant* **39**, 97-107, 1941. (Published in Germany.)

THERMAL PROPERTIES OF BUNA RUBBERS

HEATS of combustion and specific heats (from 20 to 50 deg. C.) have been measured for raw Buna S and for Buna rubbers in various stages of degradation and cyclization. The heat of combustion for raw Buna S averaged 10,394 cal. per gram at 20 deg. C. and constant volume; after aging 1.5 month the figure was 10,398. Thermal degradation (15 to 100 minutes at 130 deg. C.) lowered the specific heat progressively to 10,021 cal. per gram after 100 min. Cyclization (120 to 450 min. at 150 deg. C.) caused a smaller decrease (10,261 cal. per gram after 450 min.)

Specific heats were: raw Buna S 0.472, degraded Buna S (technical depolymerization process) 0.466, cyclized Buna S (450 min. at 150 deg. C.) 0.466. In making calculations of theoretical heats it must be remembered that Buna S is an interpolymer of butadiene with 20 percent of styrene.

Digest from "Heats of Combustion and Specific Heats of Variously Treated Buna S Rubbers," by W. A. Roth, Gerhilde Wirths and Hildegard Berendt, *Kautschuk* **17**, 31-3, 1941. (Published in Germany.)

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THEORY AND PRACTICE

THE INDUSTRIAL CHEMISTRY OF THE FATS AND WAXES. Second Edition. By *T. P. Hilditch*. Published by D. Van Nostrand Co., New York, N. Y. 532 pages. Price $7.50.

Reviewed by *Gordon W. McBride*

THIS volume brings up to date a very useful book which first appeared about fourteen years ago. Although the first edition was one of a series of "textbooks on industrial chemistry," this second edition has been published as a separate monograph. Because of this change, some of the chapters have been modified and supplemented. However, the general plan of the volume and the length are not greatly changed.

The chief new additions to fat technology which are described in the second edition include "the development of a large number of semi-synthetic detergents in which the carboxylic acids of the fatty soaps are replaced most often by salts of sulphates or sulphonates of long-chain carbon compounds; the utilization of fresh fatty oils, of semi-synthetic drying oils, and of synthetic resins in the paint and varnish industries; improvements in margarine, making this product, nutritionally and in physical properties, more nearly the equivalent of butter and superior to the latter in resistance to oxidative rancidity; and important, although not fundamental, improvements in the extraction and refining of fatty oils. The use of higher vacua and of acid-resisting metals in plant construction has contributed much to technical progress in such matters as deacidification and deodorization of fats."

In a volume of this scope, it has been impossible to deal in detail with engineering and plant construction or with the most intricate of analytic procedure. However, the book is plentifully supplied with tabular data, making a very useful reference volume. As in the first edition, no illustrations or diagrams have been used.

The first third of the book is taken up by two sections on the chemical nature and composition of fats. The next section (about one-sixth of the book) is on the extraction, refining, and hardening of fats for industrial use. Fat splitting is also dealt with here. The last half of the book is devoted to seven sections on the industrial uses of fats. Principal emphasis is placed on the edible fat industry, the soap industry, the paint industry, and the production of glycerine from fats. The other minor sections are devoted to use of fats in candles and illuminants, the application of fats to fibers, and fatty lubricants. Although the book is written with British fats and oils practice in mind, the author seems also well acquainted with the important American habits. Frequent reference is made to technics employed in this country in one industry or another.

One of the most valuable features of the book is the bibliography which is presented with each of the ten sections. References are numerous and are as recent as could be expected. The book will serve most usefully as a reference volume for anyone interested in fats and oils, both from the standpoint of data which are assembled in the first third of the book and because of the over-all presentation of the industry.

GENERAL ENGINEERING REFERENCE

INDUSTRIAL INSTRUMENTS FOR MEASUREMENT AND CONTROL. By *Thomas J. Rhodes*. Published by McGraw-Hill Book Co., New York, N. Y. 573 pages. Price $6.

Reviewed by *H. S. Winnicki*

THE NATURAL development of continuous processes in the chemical industry during the past few years and the introduction of processes in which the physical factors are of such a critical nature have made the measurement and control of physical factors of vital importance in the field of chemical engineering. This realization is exemplified by the introduction of instrumentation courses in the leading technical schools throughout the country. Unfortunately the literature in this field is found in scattered references and this text should prove to be of value in the field of teaching. It should also partially fill the need for a general reference for the practicing engineer.

The material covered in the text can be divided into three groups: industrial measuring instruments for pressure, temperature, flow, liquid level, and miscellaneous industrial instruments; telemetering; and automatic control. More than half of the text is devoted to the theory, description, and application of the various types of indicating and recording industrial measuring instruments. The design and construction of the instrument is discussed whenever it has significant bearing on its use and application. It is unfortunate that probably space limitations prevented a more detailed discussion of the many instruments used for measuring physical properties that are included in the chapter on "Miscellaneous Industrial Instruments."

One chapter is devoted to telemetering or remote indication. The principle of operation of the various types of electrical telemetering systems and pneumatic telemetering is described.

Two chapters are devoted to automatic control; one on theory and one on mechanisms. The author has included much of the excellent recent literature, published principally in the "Transactions of the A.S.M.E.," concerning the various process and instrument characteristics, the mathematical analysis of the various lags, the characteristics of controller mechanisms, the characteristics of control valves, and the relationships between these various elements in an automatic-control system in the chapter on theory. The various controller mechanisms embodied in industrial instruments and automatic control valves are illustrated and described in the chapter on mechanisms.

The order in which this material is presented does not appear to be the best possible arrangement, however, this is to be expected in a field as new as automatic control theory.

CATALOG

PLASTICS CATALOG, 1942. Published by Plastics Catalogue Corp., New York, N. Y. 624 pages. Price $5.

THE IMPORTANT role of plastics in our Victory program is stressed in many of the articles in this second plastics catalog. Methods of presentation of technical information remain the same as for the previous edition. (See *Chem. & Met.*, Feb. 1941, p. 169.) Many sections have been revised to include discussions of recent trends, a few new sections have been added, and some are essentially as they appear in last year's edition. Size of the volume has been increased by nearly 150 pages of new material and advertisements.

MARKS' HANDBOOK

MECHANICAL ENGINEERS' HANDBOOK. Fourth edition. Edited by *Lionel S. Marks*. Published by McGraw-Hill Book Co., New York, N. Y. 2274 pages. Price $7.

Now in its fourth edition, Marks' Handbook, the "bible" of the mechanical engineer, has gone through 26 printings and has sold 150,000 copies. Since the third edition in 1930, the engineering sciences have moved far, and in bringing out the latest version the editor found it necessary to present the profession with a very complete revision. Several new sections have been added, despite the superficial appearance of similarity to the last edition. Many of the sections have been completely re-written and about half the nearly 100 authors are new. Among the subjects for which new sections have been added may be mentioned: theory of models; plastic behavior of

materials; stress concentration; creep; packings; wind pressure on structures; sound and noise; automatic control of processes; and powder metallurgy. That so much new material has been incorporated without increasing the size of the already thick volume more than a few pages is a feat which was possible only through ruthless cutting of obsolete material, and absolute insistance on the part of the editor that space specifications be resolutely adhered to.

BLEACHING OF SULPHATE PULP. By *F. Loeschbrandt.* Translated by *E. Martin.* Published by the Technical Association of the Pulp and Paper Industry, New York, N. Y. 71 pages. Price $1.

Translation of the results of the investigation made by F. Loeschbrandt has been sponsored by the Pulp Purification Committee of TAPPI. The research work which was carried out in a mill at Oslo, Norway, was for the purpose of determining the influence of various factors on the course of bleaching and on the color of the finished product. Emphasis was put on the significance of variations in chemical additions, temperature, and consistency. The book is divided into sections dealing with (1) experimental methods and evaluation of analytical results, (2) pre-treatment with chlorine, (3) intermediate treatment, (4) final bleaching, and (5) chlorine consumption, whiteness and strength properties.

QUANTITATIVE ANALYSIS. Revised edition. By *Eugene W. Kanning.* Published by Prentice-Hall, New York, N. Y. 471 pages. Price (trade) $3.70, (school) $3.

Several changes and improvements may be noted in the revised edition of this textbook. The method of presentation remains the same (See *Chem. & Met.*, April 1939, p. 233). Additional aspects of the use of the balance are included and the number of illustrations of balances has been increased. A section on the calibration of volumetric ware is new and there is a more comprehensive treatment of the solubility product principle. In Part II a number of new experiments have been added.

INTRODUCTION TO CHEMICAL THERMODYNAMICS. By *Luke E. Steiner.* Published by McGraw-Hill Book Co., New York, N. Y. 516 pages. Price $4.

There are three stated objectives of Professor Steiner's book: to acquaint the student with fundamental theory, to prepare him to utilize thermodynamic data found in current literature, and to give a sound background for more extended work. To fulfill these aims the book, using modern terminology and data, covers the thermodynamic functions of physical chemistry: heat capacity, heats of reaction, free energy, ideal and non-ideal solutions, galvanic cells and other considerations as well

as the three laws of thermodynamics. Numerous problems for student consumption conclude each of the 21 chapters. Two features of the book are worthy of note: a four-page table of symbols used and an appendix giving a self-consistent listing of accepted constants.

PYROMETRY. Second edition. By *William P. Wood* and *James M. Cork.* Published by McGraw-Hill Book Co., New York, N. Y. 263 pages. Price $3.

The first edition of this book, published in 1927, has long been considered the standard reference work on the measurement of temperature. As was the first edition, the second is still intended more as a text for the teaching of temperature measurements, than as a manual for the instrument user. Thus there is considerably more on the historical and theoretical aspects than is essential for the average instrument user; and considerably less on the solution of a variety of practical application problems than he might like to find. This objection is much less pressing today, however, than it was in 1927 since much has been published in the intervening years to help with the aspects mentioned, while little that has appeared in this time has attempted to cover the field of the present authors.

That the original work was well handled is amply attested by the fact that more revision than has been made was not needed. Exactly the same field is covered in the second edition, although many new instruments have been described and considerable supplementary text has been added to clarify earlier points. In the main the illustrations have been revised, and both text and illustrations have been materially increased. While the teacher and research man will find the work a valuable one, the user too will discover that no significant industrial instrument for temperature measurement has been omitted.

FUNDAMENTALS OF QUALITATIVE CHEMICAL ANALYSIS. Second edition. By *R. K. McAlpine* and *Byron A. Soule.* Published by D. Van Nostrand Co., New York, N. Y. 375 pages. Price $2.50.

Important revisions in this new edition are contained in chapters IV and V. The former has been completely rewritten to clarify further the principles of chemical equilibrium and to stress applications to qualitative analysis. In chapter V, a new section of seven pages has been added in which semi-micro procedures for precipitation, separation, digesting and confirmatory tests are discussed. Other additions which may be noted include two new pages of discussion on the identification of nickel and cobalt, several new equations giving the reactions of arsenic, and the inclusion of many new problems at the end of each chapter. The book, containing 50 more pages, is less bulky than its first edition as a result of the use of a better grade of paper stock.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. In ordering publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, express order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, pamphlet is free and should be ordered from Bureau responsible for its issue.

Bauxite Resources of the United States, by J. R. Thoenen, and Ernest F. Burchard, Bureau of Mines Report of Investigations 3598; mimeographed.

Marketing Feldspar, by Robert W. Metcalf. Bureau of Mines Information Circular 7184; mimeographed.

Carbon Monoxide and Particulate Matter in Air of Holland Tunnel and Metropolitan New York, by W. P. Yant, Edward Levy, R. R. Sayers, Carlton E. Brown, C. E. Traubert, H. W. Frevert, and K. L. Marshall, Bureau of Mines Report of Investigations 3585; mimeographed.

Report of the Nonmetals Division, Fiscal Year 1941, by Oliver C. Ralston and A. George Stern. Bureau of Mines Report of Investigations 3599; mimeographed.

Progress Reports—Metallurgical Division. 50. Annual Report of the Metallurgical Division, Fiscal Year 1941, by R. S. Dean. Bureau of Mines Report of Investigations 3600; mimeographed.

Annual Report of the Mining Division, Fiscal Year 1941, by Charles F. Jackson. Bureau of Mines Report of Investigations 3596; mimeographed.

Annual Report of Research and Technologic Work on Coal, Fiscal Year 1941, by A. C. Fieldner and L. D. Schmidt. Bureau of Mines Information Circular 7190; mimeographed.

Position of Germany with Regard to Production and Supply of Mineral Raw Materials. Bureau of Mines; mimeographed.

Materials Consumed in Selected Industries, 1939. Bureau of the Census, Department of Commerce; mimeographed.

Water Distributing Systems for Buildings. Building Materials and Structures Report No. 79. Includes charts and tables to assist in calculating pipe sizes and other design information. National Bureau of Standards. 15 cents.

Color Charts: A Descriptive List. National Bureau of Standards, LC-665; mimeographed.

Metallurgy: Publications by Members of the Staff of the National Bureau of Standards. National Bureau of Standards, LC-664; mimeographed.

Statistical Classification of Domestic Commodities Exported from the United States, Schedule B, and Statistical Classification of Foreign Commodities Exported from the United States Schedule F. Bureau of the Census, Department of Commerce. 25 cents.

Electric Power Statistics, 1920–1940. Federal Power Commission. 25 cents.

Safety Clothing for Women in Industry. Women's Bureau, U. S. Department of Labor, Special Bulletin No. 3. 10 cents.

Handbook of Federal Labor Legislation. Part II. Labor Laws of General Application. Division of Labor Standards, Department of Labor. 150 pages.

Procurement of Supplies—Bids and Awards. War Department. 5 cents.

A New Industrial Skin Cleanser, by Louis Schwartz. Reprint No. 2311 from the Public Health Reports. U. S. Public Health Service. 5 cents.

Skin Hazards in Airplane Manufacture, by Louis Schwartz and John P. Russell. Reprint No. 2300 from the Public Health Reports. U. S. Public Health Service. 10 cents.

Fats, Oils, and Oil-Bearing Materials in the United States. United States Tariff Commission; mimeographed.

Twenty-fifth Annual Report of the United States Tariff Commission, 1941. U. S. Tariff Commission. 10 cents.

Synthetic Organic Chemicals. United States Production and Sales, 1940. Report No. 148, Second Series. U. S. Tariff Commission. 10 cents.

Production of Naval Stores. U. S. Department of Agriculture, Miscellaneous Publication No. 476. 5 cents.

Survey of American Listed Corporations. Reported Information on Selected Defense Industries: Chemicals; fertilizers. Report No. 6. Securities and Exchange Commission; mimeographed.

Mineral production statistics for 1941—preliminary mimeographed statements from Bureau of Mines on iron ore industry and copper industry. Other commodity reports are being issued during February and March. U. S. Bureau of Mines.

Analyses of Crude Oils from Some Fields of Oklahoma. II. Southern Oklahoma. Report of Investigations 3592. By E. L. Garton. Bureau of Mines; mimeographed.

List of Bulletins of the Agricultural Experiment Stations for the Calendar Years 1939 and 1940, by Catherine E. Pennington. U. S. Department of Agriculture, Miscellaneous Publication No. 459. 15 cents.

Fire-Retarding Paints, December 1941, Department of Agriculture, Forest Products Laboratory, Madison, Wisconsin; mimeographed.

Selective Service Regulations, Volume One. 32 pages. 10 cents.

Federal Specifications: Leather; Sole (Cut, Outer, and Top-Lift), Vegetable-Tanned, Factory, KK-L-26 lb.; Paint; Iron-Oxide, Ready-Mixed and semi-paste, Red and Brown, TT-P-31a; Soap, Liquid and Paste; (for) Automobile, Floor, and General Cleaning, P-S-598; Soap, Potash-Linseed-Oil: Liquid and Paste, (for) Floor and General Cleaning, P-S-603; Motor Fuel V, VV-M-57 lb.; and Amendments to various Hose specifications. Available at 5 cents per copy.

Foreign Commerce Yearbook. The last edition of the Department of Commerce volume Foreign Commerce Yearbook gave figures for 1938. It was published late in the calendar year 1939. Present policy of the Government is to not publish the next volume in this series, giving 1939 data, until some time after the war. However, data which will be included in that volume are available for consultation at the Department of Commerce in the office of Dr. Domeratzky.

CIVILIAN PROTECTION REPORTS

The Office of Civilian Defense has issued a variety of pamphlets and instructions, in addition to those previously announced, among which the following may have interest for chemical process industry.

A Handbook for Fire Watchers. 10 cents.

A Handbook for Decontamination Squads. 10 cents.

A Handbook for Demolition and Clearance Crews. 10 cents.

A Handbook for Road Repair Crews. 10 cents.

A Handbook for Messengers. 10 cents.

A Handbook for Rescue Squads. 10 cents.

A Handbook for Auxiliary Firemen. 10 cents.

A Civilian Defense Volunteer Office.

Staff Manual. U. S. Citizens' Defense Corps. 10 cents.

The United States Citizens Defense Corp.

Training Courses for Civilian Protection.

Fire Defense Organization. Fire Defense Section Bulletin No. 1. 10 cents.

Fire Protection in Civilian Defense. 10 cents.

Guide for the Training of Volunteer Nurses' Aides. 10 cents.

Report of Bomb Tests on Materials and Structures. 10 cents.

Equipment and operation of Emergency Medical Field Units. Medical Bulletin No. 2. 10 cents.

The Control System of the Citizens' Defense Corp.

MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Abrasives. The Norton Co., Worcester, Mass.—Form 1508—84-page handbook for grinding apprentices which includes elementary information on abrasives and grinding wheels. Contains tables of speeds, grinding wheel specifications, and extensive grinding wheel selection tables, together with a glossary of grinding terms. Well illustrated.

Absorption System. Fansteel Metallurgical Corp., E. Chicago, Ill.—Form TA411—22-page loose-leaf notebook on the absorption system for hydrochloric acid put out by this concern. Includes a discussion of advantages and economics, principle of absorbing hydrochloric acid, specifications, installation and capacity rating of the various systems. Each system is illustrated by a useful diagrammatic sketch.

Air Conditioning. The Carrier Corp., Syracuse, N. Y.—Bulletins 41B2, 3, 4, and 5,—2-page sheets illustrated by photographs, describing and giving specifications of this concern's line of self-contained air conditioning units for industrial and commercial establishments Contains data on heating coil locations and dimensions in inches.

Air Pumps. Gast Mfg. Corp., Benton Harbor, Mich.—Loose-leaf catalog on this concern's air pumps and compressors, with illustrations and detailed descriptions of the various models. Also includes specifications, engineering data, performance tables, photographs and description of applications in various industries.

Air Raid Siren. Federal Electric Co., Signal Div., Chicago, Ill.—4-page folder entitled "How to Select, Install and Use Sirens for Air Raid Protection." Contains illustrations, descriptive material, engineering data, system diagrams, and information on this concern's air raid sirens.

Alloys. Allegheny-Ludlum Steel Corp., Pittsburgh, Pa.—4-page bulletin entitled "Pluramelt Conserves Vital Alloys" dealing with this concern's single-armor and double-armor bonded 18-8 stainless steel material intended to save alloy. Contains brief information on forms and combinations as well as uses.

Belting. The B. F. Goodrich Co., Akron, Ohio — Section 2186 — 2-page folder of this concern's open end V-belting. Lists standard sizes, limitations, minimum recommended pulley diameters, and fasteners and tools used in installation.

Calcium. Electro-Metallurgical Co., Union Carbide & Carbon Corp., 30 East 42nd St., New York, N. Y.—Pamphlet entitled "Calcium Metal Production, A New American Industry," which discusses the present uses of calcium metal, including its use as a deoxidizer in ferrous and non-ferrous metals. Tells how calcium is added to steel, discusses effects obtained, gives available forms and methods of production.

Centrifugal Castings. The Duraloy Co., Scottdale, Pa.—Bulletin 4227C—4-page form which illustrates and describes briefly principal features, uses, analyses, and machining and welding of this concern's chrome-iron, chrome-nickel, and nickel-chrome centrifugal castings.

Chemicals. Hercules Powder Co., Wilmington, Del.—26-page catalog of this concern's products. Contains a general index listing products according to use in major industries. Another section lists in tabular form the products, principal properties of each, and condensed information on uses. Includes cellulose products, explosives, naval stores, papermakers' chemicals, sporting powders and synthetic organic materials.

Classifiers. Federal Classifier Systems, Inc., 127 N. Dearborn St., Chicago, Ill.—Bulletin 26—2-page sheet which illustrates and describes briefly this concern's laboratory air classifying unit "B". Also Bulletin 25, 6-page folder illustrating and giving information on the laboratory air classifying unit "A", including brief discussion on operation, efficiency, capacity, and power. Also Bulletin No. 5 on this concern's centrifugal air classifier. Contains illustrations of the unit and brief descriptive material.

Coal Crushers. McNally Pittsburg Mfg. Corp., 307 N. Michigan Ave., Chicago, Ill.—Bulletin 941—4-page folder on this concern's stoker coal crushers of all types. Discusses latest design improvements, gives capacity approximations and variable dimensions, and illustrates the unit by photographs and drawings.

Coatings. Munn & Steele, Inc., 120 Lister Ave., Newark, N. J.—4-page folder on this concern's "Mascote" high-temperature coating material. Gives information on physical properties of the coating, coverage, shipping information, and mixing instructions.

Compressors. Fuller Co., Catasauqua, Pa.—Bulletin C5—16-page catalog illustrating and describing the line of rotary compressors and vacuum pumps put out by this concern. Contains photographs of the units, descriptive material, cross-sectional drawings, and extensive selection data in chart form.

Concrete. Munn & Steele, Inc., 130 Lister Ave., Newark, N. J.—11-page bulletin which deals with "Mascrete," the vermiculite-aggregated concrete put out by this concern. Includes a discussion of vermiculite aggregate, properties and uses of vermiculite structural and refractory concrete, insulating properties, and various drawings and charts which give engineering data on roofs, masonry walls, floor, cold storage and fire-proof insulation.

Condensate Return System. Cochrane Corp., 17th and Allegheny Ave., Philadelphia, Pa.—Publication 3025—4-page bulletin which covers this concern's high-pressure condensate return system. Describes a typical installation in detail and includes a drawing illustrating the operation of the jet-loop principle. Detailed engineering specifications cover the technical features of design and construction.

Control Instruments. Leeds & Northrup Co., 4908 Stenton Ave., Philadelphia, Pa.—Form N003—10-page reprint entitled "Getting the Most from Automatic Control" which discusses and illustrates by photographs and sketches automatic control, modes of control, controllers as applied to a process, reactive and distant-velocity lag, effects of pressure variations and ideal effective characteristics. Contains numerous charts.

Control Instruments. Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill.—Bulletin Z-5000—12-page catalog giving a condensed listing, description and discussion of the principal items of equipment manufactured by this company. Includes photographs of the various units, schematic drawings showing possible applications, specifications, and models and prices.

Dryers. McNally Pittsburg Mfg. Corp., 307 E. Michigan Ave., Chicago, Ill.—Bulletin 741—4-page folder dealing with the centrifugal continuous mechanical dryer recently added to this concern's line. Describes the operation of units and gives specifications and cross-sectional drawings.

Electric Heating Units. Westinghouse Electric & Mfg. Co., Heating Section, Mansfield, Ohio—Catalog 28000—38-page catalog describing this concern's electric heating unit and controls, including

strip, finned, cartridge and water and oil immersion heaters, electric glue and melting pots, thermostats and controls, and special heating elements. Extensively illustrated. Contains engineering data on specifications, industrial calculations, heat losses, application data and selection information. Also contains list prices.

Electric Tools. Wodack Electric Tool Corp., 4627 W. Huron St., Chicago, Ill. —Catalog 45—16-page catalog on this concern's electric tools for construction, installation, production and maintenance, including hammers and drills, cutters, grinders, and accessories. Illustrates, describes and gives specifications of each model.

Equipment. Denver Equipment Co., 1400-17th St., Denver, Colo.—Catalog G-4200—16-page catalog on this concern's reconditioned and new equipment of various types such as agitators, ball mills, classifiers, feeders, filters, laboratory machines, etc. Each unit is illustrated, described briefly with specifications and list prices.

Equipment. Eppenbach Inc., 45-10 Vernon Blvd., Long Island City, N. Y.— 6-page folder describing briefly and illustrating the colloid mills, homo-mixers and agi-mixers for chemical and process industries put out by this concern.

Equipment. The Jeffrey Mfg. Co., Columbus, Ohio—Catalog 765—20-page catalog illustrating and briefly describing this concern's equipment for the process industries, including feeders, conveyors, elevators, screens, power transmmission machinery and other units. Contains tables of capacities and specifications.

Equipment. Swenson Evaporator Co., 15649 Lathrop Ave., Harvey, Ill.—8-page folder on this concern's evaporators, filters and crystallizers. Includes description of the various units, cross-sectional drawings, and photographs of installations. Also two pages of typical flowsheets showing the use of these units in various chemical and process industries.

Glue Softener. Atlas Powder Co., Wilmington, Del.—8-page folder on this concern's commercial sorbitol solution called "Arlex" as a softener for flexible glues. Describes the material, its role as a softener, flexible glue formulations, moisture protection, typical formulations, physical properties and details of uses in various types of glues.

Illumination. E. I. duPont de Nemours & Co., Inc., Finishes Division, Wilmington, Del.—Form A2615—24-page booklet entitled "Three Dimensional Seeing" which discusses and illustrates novel features of the application of combinations of color and light to industrial plants for increasing production, reducing accident hazards, improving working conditions and improving labor relations. Explains how proper illumination and selective color painting of machine working parts help to accomplish these objectives. Well organized and illustrated with photographs of actual applications.

Instruments. Cambridge Instrument Co., Inc., 3732 Grand Central Terminal, New York, N. Y.—List CEC—4-page folder which lists, illustrates and describes briefly this concern's analyzers, indicators and recorders for precise measurement in power plants, process industries and in laboratories.

Instruments. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.— Catalog E90 (1)—12-page catalog describing this concern's microphotometer for analyzing spectrographic plates or films in industrial and research laboratories. Includes descriptive material on the unit and its various parts and their operation and photographs of the various types of units.

Instruments. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.— Catalog E-91-163—16-page bulletin on this concern's Micromax CO_2 recording equipment for flue-gas analysis, a.c.-operated and of the saturated-gas type. Contains a complete description of the equipment, full-sized color reproduction of round and strip chart records, circuit diagrams, and mounting dimensions.

Instruments. The Meriam Co., 1955 W. 112th St., Cleveland, Ohio—Form

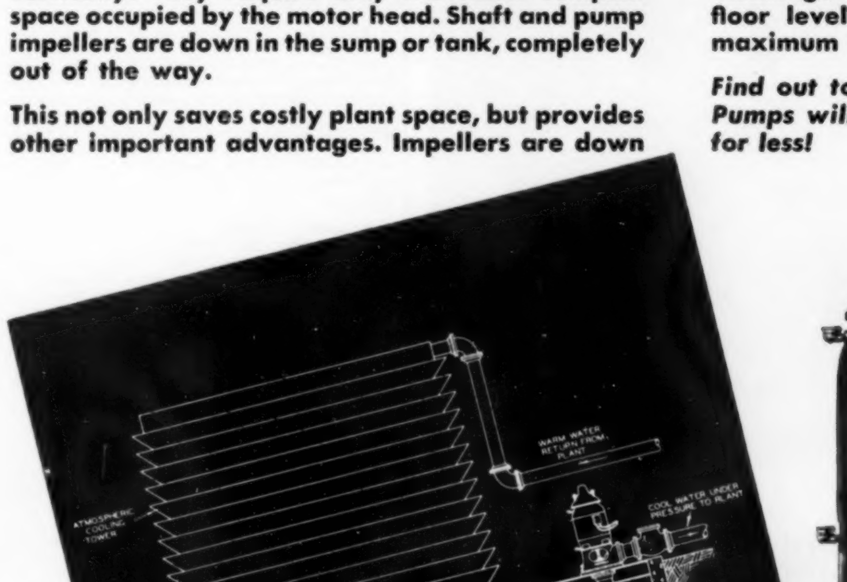
Why waste costly plant space

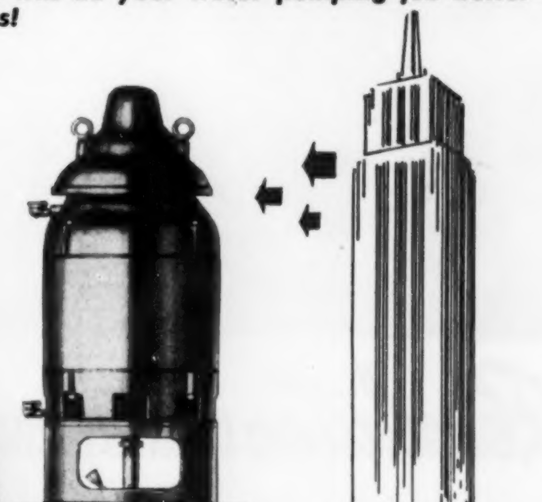
WITH PUMPS OF OUTMODED DESIGN?

POMONA VERTICAL PUMPS are as compact and space-saving as a modern skyscraper. Instead of wasting valuable floor space with complicated piping . . . and with shafting, motor and pump spread "broadside" . . . Pomona Pumps operate *vertically*. They require only the small compact space occupied by the motor head. Shaft and pump impellers are down in the sump or tank, completely out of the way.

This not only saves costly plant space, but provides other important advantages. Impellers are down below water level, instantly ready to go *without priming*. Shaft and bearings are in the water stream, completely lubricated by the water being pumped, eliminating maintenance and oiling at these points. And the piping is simplified, for the discharge can be placed at, above—or *below*—floor level . . . wherever is most convenient for maximum compactness and plant efficiency.

Find out today the many ways Pomona Vertical Pumps will do your water pumping job better—for less!

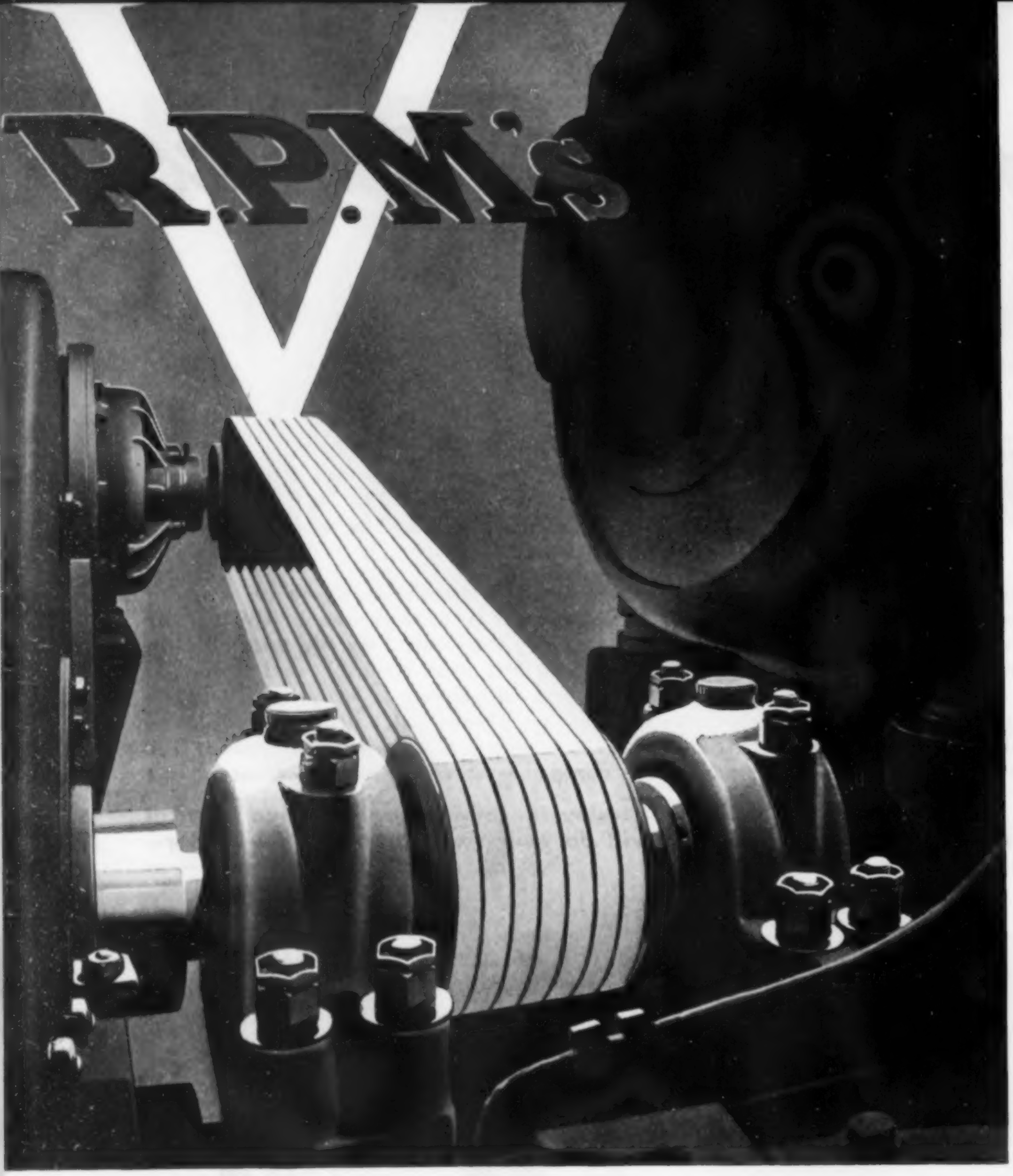




COOLING and CIRCULATING: *I[...]e is a typical Pomona cooling pump install[...] Note how Pomonas save space and eliminate complicated and expensive pipe layouts. What's more, they are easily adjustable for varying head requirements with proportionate savings in power . . . they may be installed in the open without need for housing — in basements, on roofs, over tanks or reservoirs — wherever is most convenient . . . and, because they are lubricated by the water being pumped, constant care and attention are eliminated.*

POMONA
Water-Lubricated
PUMPS

POMONA PUMP CO., 120 Broadway, New York City
Plants located at 4301 South Spring Avenue, St. Louis, Missouri, and 206 Commercial Street, Pomona, California



C10—8-page condensed catalog describing this company's line of manometers, draft gages, flowmeters, mercury pressure gages, tank gages and all accessories for measuring pressures, vacuum and flow of liquids and gases. Contains illustrations of the equipment, suggestions for use, size ranges, dimensions, and list prices.

Lathes. South Bend Lathe Works, 425 East Madison St., South Bend, Ind. —Bulletin 67T—4-page bulletin describing briefly and illustrating this concern's new 2-H turret lathe. Includes complete specifications and details of construction features.

Machinery Cleaner. Ideal Commutator Dresser Co., 1274 Park Ave., Sycamore, Ill.—4-page folder which describes briefly the vacuum-blow-spray portable machinery cleaners put out by this concern. Illustrates accessories and applications.

Milk Products. Sealtest, Inc., 230 Park Ave., New York, N. Y.—22-page booklet dealing with the industrial uses of milk. Contains condensed information on properties and suggested uses of such milk byproducts as casein, casein paint, lactose, lactic acid and lactates and other products.

Odor Adsorber. W. B. Connor Engineering Corp., 114 E. 32nd St., New York, N. Y.—4-page folder which illustrates and describes briefly the portable, general purpose odor adsorber put out by this concern.

Patents. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Form R6198—56-page bulletin entitled "Patent Background for Engineers," with articles by various authorities on patent policies, protecting new inventions, inventions for sale, joint inventorship, patent interference, trademarks, etc. Well illustrated, very well organized, and full of helpful ideas for engineers and chemical patent specialists.

Plastics. Rohm & Haas Co., 222 W. Washington Sq., Philadelphia, Pa.—48-page handbook entitled "Plexiglas Fabricating Manual." Contains valuable information on methods and machines, buffing compounds, etc., used in the machining and fabrication of this material. Information well organized into heads such as machining, forming, checking fixtures, cementing, cleaning, finishing, and repairing and patching. Well illustrated with photographs and diagrammatic drawings.

Plasticizing Oils. The Neville Co., Neville Island, Pittsburgh, Pa.—20-page revised edition of this concern's handbook on plasticizing oils of various types. Contains information on miscibilities and compatibilities, physical properties, specifications and uses. Also contains specific gravity and temperature conversion tables.

Power Transmission. Standard Oil Co. (Ind.), Sales Technical Service Dept., Chicago, Ill.—Form 4TP111—52-page construction manual for industrial salesmen on power transmission equipment and its lubrication. Illustrates and discusses the various types of such equipment, applications in industries, maintenance, lubrication, and similar information primarily intended for industrial salesmen. Extensively illustrated by photographs and drawings.

Properties of Solutions. Technical Service Bureau, Inc., 6805 N. Clark St., Chicago, Ill.—Chart A101, 102, and 103 —one-page charts, the first of which gives properties of caustic soda solutions and shows relationship between percent Na_2O, percent NaOH, specific gravity, and degrees baume. The second gives properties of sugar solutions, including relationship between index of refraction, degrees Brix, specific gravity and pounds per gallon of sucrose solution. The third shows the pH of 21 buffering systems in water solutions ranging in concentration from 0.25-8 percent.

Pumps. The Watson-Stillman Co., Roselle, N. J.—Form 240A—4-page bulletin which describes briefly, illustrates and gives specifications for this concern's hand-operated, high-pressure pumps for testing purposes and for operating hydraulic jacks and other small hydraulic tools.

Refractories. General Refractories Co., Philadelphia, Pa.—72-page booklet

containing extensive information on this concern's various type refractories, including fireclay brick, high alumina brick, silica and basic brick. Describes and illustrates each item and gives complete specifications together with notes on industrial uses. Also contains extensive tables useful in figuring proper number and combinations of brick in firebrick construction. Well illustrated.

Roofing. Porcelok Co., Division of Davidson Enamel Co., Clyde, Ohio—Form 12415M—6-page folder dealing with this concern's corrugated porcelain enameled roofing and siding for various industrial purposes. Includes brief descriptive material, photographs of applications, and sketches of typical flashings together with engineering and specification data.

Rubber Putty. The B. F. Goodrich Co., Akron, Ohio.—Section 9765—2-page sheet dealing with the rubber-base putty put out by this concern for glazing and sealing and used in chemical plants, marine service, etc. Describes properties, corrosion resistance, grades, applications and gives directions for use.

Safety. Kimball Safety Products Co., 7314 Wade Park Ave., Cleveland, Ohio—20-page folder of bulletins on equipment put out by this concern for eye, body, and hand protection. Includes illustrations, specifications, and description of such protective equipment as goggles of various types, helmets, sleevelets, aprons, leggings, gloves, and various protective items for welders.

Steam Traps. Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.—Bulletin T-1736—16-page bulletin giving information on construction features, operating principles, capacities, prices, weights and dimensions, on this concern's impulse steam traps. Extensively illustrated by installation photographs and diagrammatic sketches. Contains considerable engineering data in chart form.

Steel. Jessop Steel Co., Washington, Pa.—16-page price list for the line of silver-ply stainless-clad steel put out by this concern. Includes tables on machining, shearing and flatness tolerances, estimated weight, and size limits for standard production plates and sheets.

Steel Tubing. The Babcock & Wilcox Tube Co., Beaver Falls, Pa.—Bulletin entitled "Properties of Carbon and Alloy Steel Tubing for High Temperature-High Pressure Service". Includes data on physical properties and behavior in service of this concern's products, together with new sections on seamless-tube manufacturing process, rupture testing, maximum allowable working stresses, effect of hydrogen, and air-hardening properties. Includes an illustrated section on common causes of tube failure.

Stokers. American Engineering Co., Philadelphia, Pa.—Catalog W—8-page folder which describes the operations, advantages, and applications of this concern's water-cooled stoker. Extensively illustrated by photographs and diagrammatic drawings.

Test Papers. Carl Schleicher & Schull Co., 116 W. 14th St., New York, N. Y.—Bulletin 2—4-page folder on the application of this concern's Yagoda confined spot test papers for the detection and identification of toxic gases, including hydrogen sulphide, arsine, chlorine, phosgene, hydrocyanic acid and chloropicrin. Contains a brief bibliography on the use of spot tests in gas analysis and also a price list.

Thickeners. T. Shriver & Co., 810 Hamilton St., Harrison, N. J.—Bulletin 114—4-page folder dealing with this concern's thickener for thickening, washing and leaching. Includes photographs of the unit, discussion of operating principles, design, advantages, applications, and flow diagram circuits.

Truck Tires. The B. F. Goodrich Co., Akron, Ohio—98-page operator's handbook dealing with the quality, type, size, and proper use of truck, tractor and implement tires. Contains a 15-page section dealing with factors governing truck tire service, with charts and tables showing the value of proper inflation and loads, causes of uneven tread wear and other factors that shorten the life of tires. Well illustrated.

CHEM & MET

ECONOMICS & MARKETS

ALLOCATION CONTROLS AFFECT INDUSTRY CONSUMPTION OF CHEMICALS AND RELATED PRODUCTS

An informative view of the transition which is taking place in many lines of industry is given in a survey of the Department of Commerce which states that output for military use continues to move ahead as an ever-growing number of industries restrict their production for civilian consumption. In general, the formal limitation is being implemented by two procedures. A number of industries are allowed only a fraction of the quantity of certain essential raw materials which they used during a stipulated base period. Producers of the raw materials—lead, copper, and rubber, are examples—are made responsible for the reduced shipments. In other cases producers of finished civilian goods are ordered directly to limit their output for civilian consumption. Altogether 18 industries now fall in this category, some of them, such as the automobile industry, being forced to curtail civilian output completely. A number of the recent limiting orders, like those applying to distillers, woolen textiles, and radio manufacturers, in effect, simply reserve a substantial proportion of existing capacity for military demand. Little alteration in the character of the facilities is required, and the aggregate activity in such lines will continue high, though inability to obtain scarce raw materials may eventually bring some decline.

This statement while made for business in general has a definite application to the industries which draw heavily upon chemicals as raw materials. That over-all consumption of chemicals is moving up steadily is attested by the fact that production facilities are constantly being enlarged, yet the entire production is moving into channels of distribution without being able to fill all demands. As an offset to the loss which results from restricting use of chemicals in some directions, there is a larger use in some of the large manufacturing lines, outside of munitions, because more of this type of finished product is now needed as an integral part of the war effort. For instance the extensive demand for woolen goods in the military program insures a high rate of operation at mills with chemicals required accordingly. Oil refining programs will be stepped up to new highs this year, steel mills will be asked to increase their outputs, fertilizer needs are increased to comply with larger needs for agricultural products.

That every attempt will be made to enable production of chemicals to reach its maximum, is attested by the action taken by the Division of Industry Operations of the War Production Board which late in January resulted in the issuance of an order stating that running at full capacity in the production of vital military and civilian needs, the war chemical industry is to receive the assistance of high priority ratings in securing necessary repair, maintenance and operating supplies. Preference order P-89 assigns an A-1-a rating to deliveries of materials to repair actual breakdowns; A-1-c rating to materials required to avert immediately threatened stoppages; and A-3 rating to the procurement of materials for other repairs, maintenance and operation. As the primary materials requirements of the industry are protected through priority controls, uninterrupted operations are safeguarded as far as possible.

Interruptions to expanded programs may be met from time to time as recent reports indicate that a shortage of electric power threatens in some centers where large electrochemical enterprises are centered particularly in New York where a survey has indicated that rationing may be found necessary. Surplus power of New York City is said to be available but transmission facilities are lacking.

Despite the effects of restrictive regulations, the consumption index for industrial consumption of chemicals moved upward in January to 170 which compares with the revised number of 167.79 for December and with 144.85 for January of last year. Seasonal influences have been favorable for enlarged operations at acidulating plants, and operations at textile, oil refineries, rayon, and glass works have been maintained at high levels. While plate glass outputs have been dropping because of loss of business in the automotive trade, window glass production has been increased and the outturn of containers is held up by their substitution for other packaging materials which have become scarce.

In the plastics industry, production of phenol-formaldehyde types has been large but has been prevented from reaching maximum figures because supplies of formaldehyde have not been large enough to permit further plastics expansion. Cellulose plastics, on the other hand, have shown an amazing growth, especially in cellulose acetate molding composition. Production of molding composition last year was reported at 30,716,617 lb. which compares with 14,962,813 lb. produced in 1940 and 11,654,928 lb. produced in 1939.

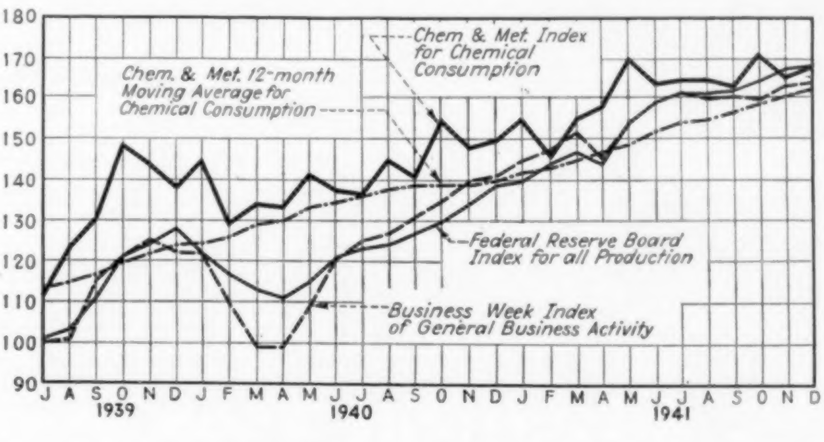
As indications of the speeding up in rates of operation in December in some lines of manufacture, the output of molded composition at cellulose acetate plastics plants amounted to 3,397,398 lb. which was the second highest monthly total on record, having been exceeded only in October, 1941.

At byproduct coke plants, production of sulphate of ammonia was an all-time high, amounting to 131,239,254 lb. Production of toluol at 2,643,254 gal. also a record as was the 5,618,776 lb. of ammonia liquor turned out.

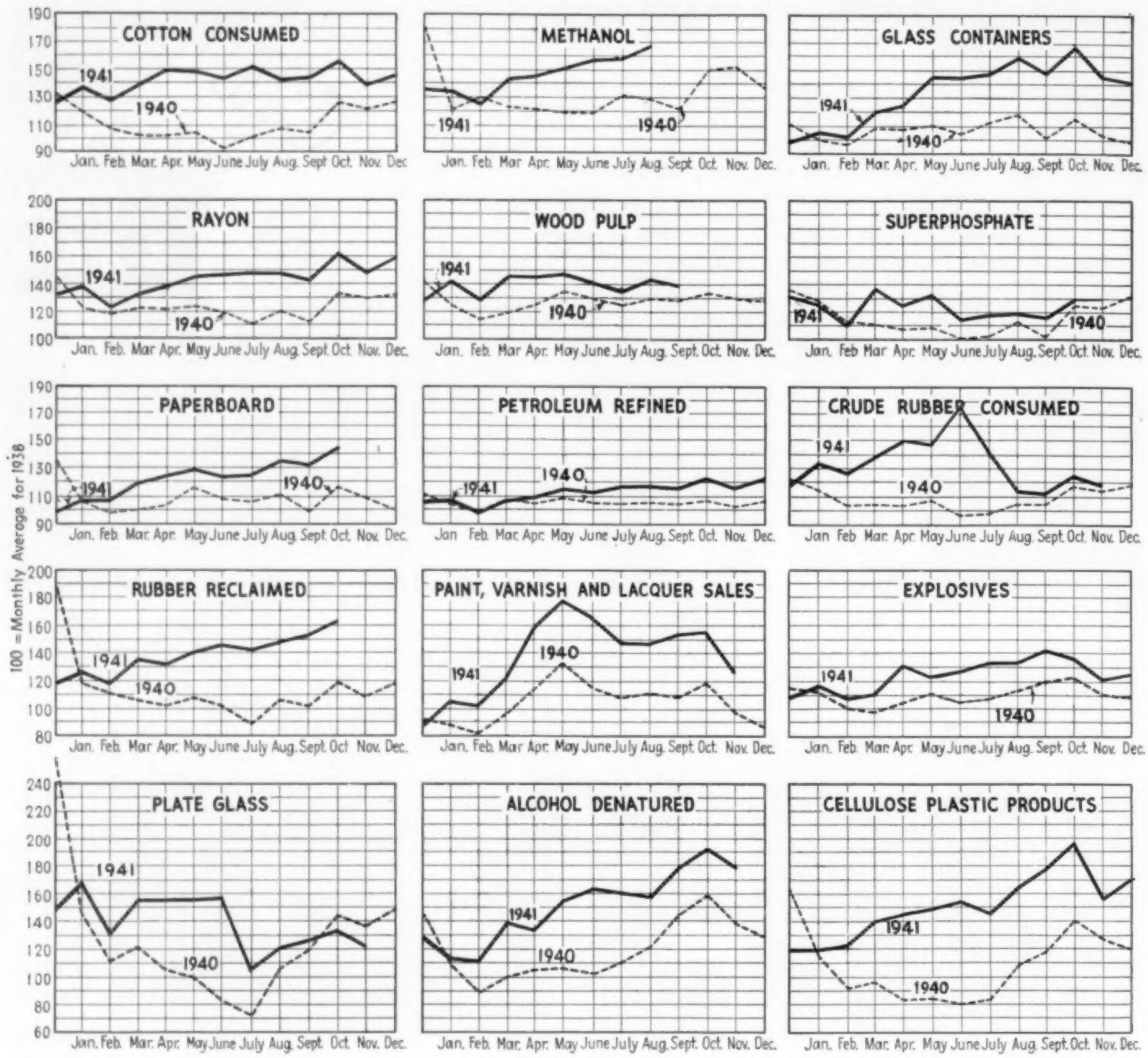
Chem. & Met. Index for Industrial Consumption of Chemicals

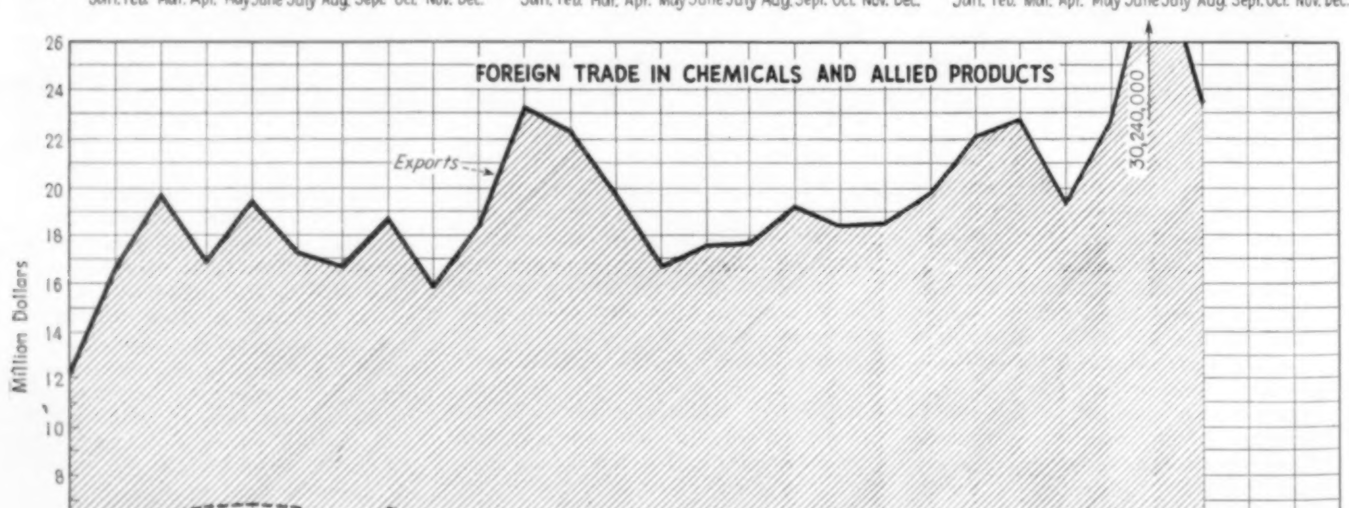
1935 = 100

	Nov. revised	Dec.
Fertilizer	32.40	33.00
Pulp and paper	22.13	22.30
Petroleum refining	15 68	16.26
Glass	15.10	14.95
Paint and varnish	13.43	13.00
Iron and steel	12.71	13.10
Rayon	13.30	14.30
Textiles	10.80	12.25
Coal products	9,26	9.79
Leather	4.80	5.10
Explosives	5.47	5.67
Rubber	3.80	4.00
Plastics	3.95	4.07
	162.83	167.79



Production and Consumption Trends





"...but can I get cork insulation?"

THAT'S the question which has been asked by many hundreds of insulation users since last June, when cork was put on the government's mandatory priorities list. It is not surprising that there are questions as to how much corkboard and cork covering is available and who *can* get it.

Most users know that cork must be imported from Portugal, Spain, or Algeria. They realize that shipping is severely restricted . . . that normal peace-time imports are out of the question. Some users even think that, because of these restrictions, little or no cork insulation is available for *any* purpose.

HERE IS THE SITUATION

Armstrong's Corkboard and Cork Covering are available for uses where they aid defense. Included in this category are direct defense uses such as insulation for Naval craft, powder plants, and refrigerated storages at Army camps and Navy bases. Of comparable importance are chemical plants and other vital producers. Plants making synthetic rubber and oil refineries for example can also get this efficient insulation.

After direct defense needs are met, the remainder from supplies allocated monthly is available chiefly for food preservation. In recent months many meat packers, dairy operators, and others in the perishable foods field have been getting the efficient, dependable insulation they needed . . . Armstrong's Corkboard and Cork Covering.

If you're planning new insulated construction get in touch with your Armstrong Cork man. The information he gives you will be authentic. His suggestions will be helpful. And Armstrong's engineers will be glad to go over your plans and offer their suggestions which may avoid delays and expense later on.

So don't guess about your insulation needs. Call the nearest Armstrong office or distributor now and get the information you want about deliveries of corkboard and cork covering. Or write direct to Armstrong Cork Co., Building Materials Div., 919 Concord St., Lancaster, Pa.

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Insulation Headquarters

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TRADING IN CHEMICALS AND OILS AND FATS COMES UNDER CONSTANTLY GROWING SUPERVISION

Although deliveries of many chemicals are under allocation control, this has not slowed up the movement to consumers and total tonnage moved last month was reported to have shown an appreciable gain over that for the preceding month. The outstanding feature to trading is the control now exercised over both distribution and prices. In both instances this is increasing as the supply situation makes it necessary to dictate where the chemicals are most vitally needed and the holding of prices within reasonable bounds is regarded as equally important.

Among important developments affecting distribution was an announcement that despite the shortage, necessary amounts of chlorine will be provided for water purification purposes. The announcement further stated that high test calcium hypochlorite and chloride of lime were more scarce than chlorine and sodium hypochlorite and suggested that substitution of the latter be made where possible. Complete allocation of sodium nitrate will be undertaken from Feb. 1. Demand for fertilizer is expected to exceed the supply on hand and strict rationing among the several uses will be necessary. Scarcity of tonnage for moving nitrate from Chile makes the import outlook uncertain. Incidentally a new schedule of prices for nitrate was announced by a domestic producer making quotations $27 a ton, bulk, fob shipping point; $3.05 per 100 lb. in 100 lb. bags; and $2.35 a 100 lb. in 200-lb. bags.

To protect essential uses, mercury also was subject to a conservation order which sets up a List A of consumers who are requested after Jan. 15 not to use this material in excess of 50 percent of requirements during a given base period. After April 1 the use of mercury in the specified lines is to be entirely discontinued. List A comprises carroting hat fur, marine antifouling paint, thermometers (except industrial and scientific), treating green lumber (except Sitka spruce), turf fungicides, vermilion, wall switches for non-industrial use, and wood preservation. List B of the order contains articles whose manufacture may be continued at full and in the case of mercuric fulminate it may reach 125 percent of the rate during the first quarter of 1940 or 1941 at the option of the manufacturer.

Sweeping restrictions on the use of lead made exceptions for glass for optical and scientific purposes, for lead arsenite, and pigments and driers. Diphenylamine likewise went under allocation control on Feb. 1 because increased military demands had caused a scarcity but new production is being considered to relieve the shortage.

While the roster of chemicals which have come under price regulations has increased in number the price trend has been upward since the ceilings and agreements have considered higher production costs and the maximums allowed are above the price levels which were current over the greater part of last year. A base maximum price of 6½c a lb. was established for primary lead around the middle of January and at the same time producers of pigments were asked not to raise their sales figures above the level ruling on Jan. 2. In the meantime a survey was made of the lead pigments industry and a higher price schedule went into effect on Jan. 30 with official sanction. Although the market for lithopone had been stabilized by agreement, an official ceiling of 4¼c a lb. for ordinary grade was set, effective Feb. 2. This was in line with the agreement price and the explanation for the change in status was that speculation by others than producers had increased resale prices and promised to put them even higher. The additional .03 per 100 lb. permitted on export sales has brought protests from exporters not only on the ground that the margin of profit was too small to admit of trading but also that the export differential was lower than that set in the case of other chemicals. The price for zinc sulphide also was included in this order with the carlot price for delivery in the eastern territory fixed at 8¼c a lb. and less than carlots at 8¾c a lb.

A request for permission to mark up sales schedules for borax and boric acid had been held in abeyance but in the latter part of January producers received telegrams stating that until March 24, 1942 you are requested not to sell borax and boric acid at prices in excess of the following fob plant, freight allowed: borax, granular, technical in bulk, $41.50; boric acid in bulk, $95.50; regular differentials to apply to shipments in containers and to both products sold in commercial forms. As a consequence of expanded economic activity emphasized by defense and then by war, demand for oxalic acid has increased rapidly and to avert inflationary prices a schedule was issued establishing 11¼c a lb. as the maximum for carlots fob ship-

CHEM. & MET.

Weighted Index of

CHEMICAL PRICES

Base=100 for 1937

This month	**109.20**
Last month	109.01
February, 1941	99.98
February, 1940	98.96

Prices have become so stabilized either through agreements or through government control that any wide fluctuations from month to month are not to be expected although the average level is considerably higher than a year ago.

ping point. The less carlot price ranges from 11¾c to 12½c a lb. depending on quantity. Export maximums add to this schedule, the freight rate from the nearest producing point to the port of shipment plus .006c a lb.

Carbon tetrachloride has been in restricted supply for some time because of the shortage of chlorine required for its production. With the shortage becoming accentuated, ceiling prices went into effect on Feb. 2. The new prices vary according to zone of delivery with zone 1 at 5¼c a lb. for tank cars, delivered; drums in carlots 73c. a gal. and less than carlots ranging from 80c to $1.07 a gal. The zone prices apply on export shipments fob vessel plus 6½c. a gal. Increased demand for this product was reported to be due to use of the chemical for cleaning machine tools and metal parts employed in manufacture of airplane engines, military trucks, munitions, and many other products.

Other chemicals which have been under price considerations include salicylic acid, theobromine, aspirin, citric acid, and Vitamin C (ascorbic acid). Fluorspar producers also were asked not to raise prices above the Jan. 2 level without giving notice one month in advance of any prospective change. It was pointed out that this mineral was of considerable commercial importance in manufacturing steel, aluminum, ceramic and chemical products and refrigerants.

The market for oils and fats has continued in an unsettled position due in part to restrictions surrounding trading and in part to the uncertain position of import trade in some of the important commodities. Coconut oil is in a nominal position as shipments from the Philippines have been shut off and holders of oil in this country have no knowledge of replacement costs or of when replacements may be possible. The War Production Board removed the order restricting stocks of oils and fats to a three months period but in its place are restrictions on processing. This order directs that producers turn out no more of their product than is required to fill orders and give the producer a practicable minimum working inventory. Tung oil was placed under strict priority control early in the year.

CHEM. & MET.

Weighted Index of Prices for

OILS & FATS

Base=100 for 1937

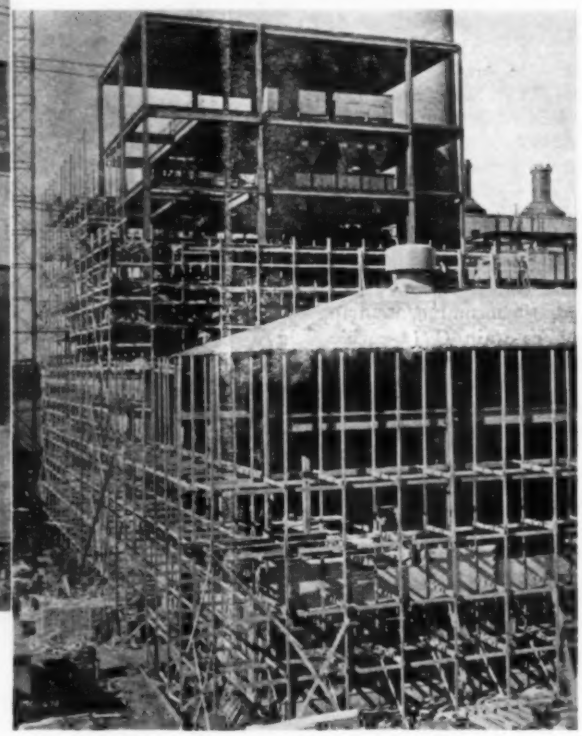
This month	139.36
Last month	135.60
February, 1941	75.45
February, 1940	82.40

Most of the oils reached full ceiling limits during the past month and the index number has moved up about as high as it can go unless protests that some of the ceilings are too low brings a modification.

CALCO CHEMICAL COMPANY REPEATS

Calco Chemical Co., Bound Brook, N. J., 9 VF Multiclone installation 144 tubes—9" diameter handling 72,000 c.f.m. at 300° F.

Calco Chemical Co., Bound Brook, N. J., 9 VF Multiclone installation 2 units—130 tubes each—9" diameter handling 100,000 c.f.m. at 300° F.



Before purchasing the first VF Multiclone unit, Calco engineers made an exhaustive search of the market for fly ash collector equipment to determine the best type. Numerous tests were conducted not only with a VF Multiclone test unit but with other collectors. The VF Multiclone efficiencies ran so high that some SEVENTEEN consecutive tests were run under a great variety of boiler rating to check this high efficiency. In addition to their efficiency the cast iron tubes and cast iron vanes provide unusual strength and wear resistance.

The first VF Multiclone installation handled 72,000 c.f.m. at 300° F. with a 2" P. D. The results were so satisfactory that at once an order was placed for a second unit practically twice as large to handle 100,000 c.f.m.

Fly ash causes endless troubles not only as a nuisance but as a veritable liability to employees and production alike. You will find our Bulletin FA-1 contains information of value on Fly Ash elimination. Write for your copy today. It's entirely free.

Our engineers will be glad to visit your plant and discuss your problems with you. Write or phone our nearest office for information.

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CHEM & MET CURRENT PRICES

The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to February 13

INDUSTRIAL CHEMICALS

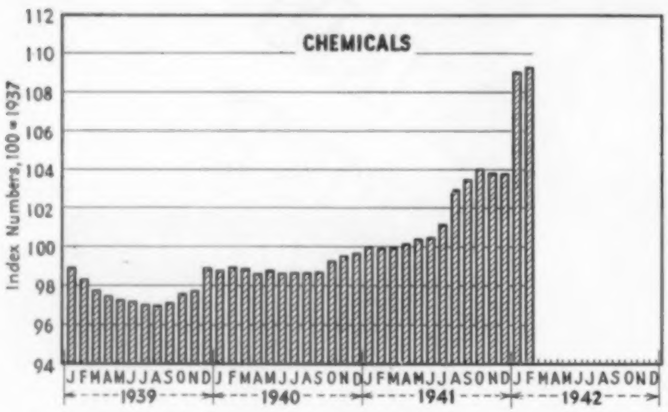
	Current Price	Last Month	Last Year
Acetone, drums, lb	$0.168-$0.173	$0.168- $.173	$0.07½-$0.08
Acid, acetic, 28%, bbl., cwt	3.38 - 3.63	3.38 - 3.63	2.23 - 2.48
Glacial 99.5%, drums	9.15 - 9.40	9.15 - 9.40	8.43 - 8.68
U. S. P. X 1, 99.5%, dr	10.95 -11.20	10.95 -11.20	10.25 -10.50
Boric, bbl., ton	108.00-113.00	106.00-111.00	106.00-111.00
Citric, kegs, lb	.20 - .23	.20 - .23	.20 - .23
Formic, cbys., lb	.10½- .11	.10½- .11	.10½- .11
Gallic, tech., bbl., lb	1.10 - 1.15	1.10 - 1.15	.90 - 1.00
Hydrofluoric 30% drums, lb	.08 - .08½	.08 - .08½	.08 - .08½
Lactic, 44%, tech., light, bbl., lb	.073- .075	.073- .075	.06½- .06¾
Muriatic, 18°, tanks, cwt	1.05 -......	1.05 -......	1.05 -......
Nitric, 36°, carboys, lb	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks., ton	18.50 -20.00	18.50 -......	18.50 -20.00
Oxalic, crystals, bbl., lb	.11½- .13	.11½- .13	.10½- .12
Phosphoric, tech., c'bys., lb	.07½- .08½	.07½- .08½	.07½- .08½
Sulphuric, 60°, tanks, ton	13.00 -......	13.00 -......	13.00 -......
Sulphuric, 66°, tanks, ton	16.50 -......	16.50 -......	16.50 -......
Tannic, tech., bbl., lb	.71 - .73	.71 - .73	.54 - .56
Tartaric, powd., bbl., lb	.70 -......	.70 -......	.50 -......
Tungstic, bbl., lb	nom......	nom......	nom......
Alcohol, amyl	......	......	......
From Pentane, tanks, lb	.131-......	.131-......	.111-......
Alcohol, Butyl, tanks, lb	.158-......	.158-......	.09 -......
Alcohol, Ethyl, 190 p'f., bbl., gal	8.19 - 8.25	8.19 - 8.25	6.04 -......
Denatured, 190 proof	......	......	......
No. 1 special, dr., gal. wks	.60 -......	.60 -......	.31½-......
Alum, ammonia, lump, bbl., lb	.03¾- .04	.03¾- .04	.03¾- .04
Potash, lump, bbl., lb	.04 - .04¼	.04 - .04¼	.03¾- .04
Aluminum sulphate, com. bags, cwt	1.15 - 1.40	1.15 - 1.40	1.15 - 1.40
Iron free, bg., cwt	1.85 - 2.10	1.85 - 2.10	1.60 - 1.70
Aqua ammonia, 26°, drums, lb	.02¾- .03	.02¾- .03	.02¾- .03
tanks, lb	.02 - .02¼	.02 - .02¼	.02 - .02¼
Ammonia, anhydrous, cyl., lb	.16 -......	.16 -......	.16 -......
tanks, lb	.04½-......	.04½-......	.04½-......
Ammonium carbonate, powd. tech., casks, lb	.09½- .12	.09 - .12	.09 - .12
Sulphate, wks., cwt	1.45 -......	1.45 -......	1.45 -......
Amylacetate tech., from pentane, tanks, lb	.145-......	.125-......	.105-......
Antimony Oxide, bbl., lb	.15 -......	.15 -......	.12-......
Arsenic, white, powd., bbl., lb	.04 - .04½	.04 - .04½	.03 - .03½
Red, powd., kegs, lb	nom......	nom......	.17 - .18
Barium carbonate, bbl., ton	60.00 -65.00	60.00 -65.00	52.50 -57.50
Chloride, bbl., ton	79.00 -81.00	79.00 -81.00	79.00 -81.00
Nitrate, casks, lb	.10½- .11	.10½- .11	.08½- .10
Blanc fix, dry, bbl., lb	.03½- .04	.03½- .04	.03½- .04
Bleaching powder, f.o.b., wks., drums, cwt	2.25 - 2.35	2.00 - 2.10	2.00 - 2.10
Borax, gran., bags, ton	44.00 -......	43.00 -......	43.00 -......
Bromine, cs., lb	.30 - .32	.30 - .32	.30 - .32
Calcium acetate, bags	3.00 -......	3.00 -......	1.90 -......
Arsenate, dr., lb	.06½- .07	.06½- .07	.06½- .06¾
Carbide drums, lb	.04¾- .05	.04¾- .05	.04¾- .05
Chloride, fused, dr., del., ton	19.00 -24.50	19.00 -24.50	19.00 -24.50
flake, dr., del., ton	20.50 -25.00	20.50 -25.00	20.50 -25.00
Phosphate, bbl., lb	.07½- .08	.07½- .08	.07½- .08
Carbon bisulphide, drums, lb	.05½-......	.05½-......	.05 -......
Tetrachloride drums, gal	.73 - .80	.73 - .80	.66½- .73
Chlorine, liquid, tanks, wks., lb	2.00 -......	2.00 -......	1.75 -......
Cylinders	.05¼- .06	.05¼- .06	.05½- .06
Cobalt oxide, cans, lb	1.84 - 1.87	1.84 - 1.87	1.84 - 1.87
Copperas, bgs., f.o.b., wks., ton	18.00 -19.00	18.00 -19.00	18.00 -19.00
Copper carbonate, bbl., lb	.18 - .20	.18 - .20	.10 - .16
Sulphate, bbl., cwt	5.15 - 5.40	5.15 - 5.40	4.75 - 5.00
Cream of tartar, bbl., lb	.57 -......	.57 -......	.43¼-......
Diethylene glycol, dr., lb	.22 - .23	.22 - .23	.22 - .23
Epsom salt, dom., tech., bbl., cwt	1.90 - 2.00	1.90 - 2.00	1.80 - 2.00
Ethyl acetate, drums, lb	.12-......	.12 -......	.07½-......
Formaldehyde, 40%, bbl., lb	.05½- .06	.05½- .06¼	.05½- .06
Furfural, tanks, lb	.09 -......	.09 -......	.09 -......
Fusel cil, drums, lb	.17½- .19	.17½- .19	.16 - .17
Glaubers salt, bags, cwt	1.05 - 1.10	1.05 - 1.10	.95 - 1.00
Glycerine, c.p., drums, extra, lb	.18¾-......	.18¾-......	.12½-......
Lead;			
White, basic carbonate, dry casks, lb	.08¼-......	.07½-......	.07¼-......
White, basic sulphate, sck., lb	.07¼-......	.07¼-......	.07 -......
Red, dry, sck., lb	.09½- .08¾	.0835......	.08 -......
Lead acetate, white crys., bbl., lb	.12 - .13	.12 - .13	.11- .12
Lead arsenate, powd., bag, lb	.09½- .11	.09½- .11	.09½- .11
Lime, chem., bulk, ton	8.50 -......	8.50 -......	8.50 -......
Litharge, pwd., csk., lb	.08½......	.0735......	.C7 -......
Lithopone, bags, lb	.04¾- .04½	.C4¼- .C4½	.038- .04
Magnesium carb., tech., bags, lb	.06¼- .06½	.06¼- .C6½	.06¼ - .06½

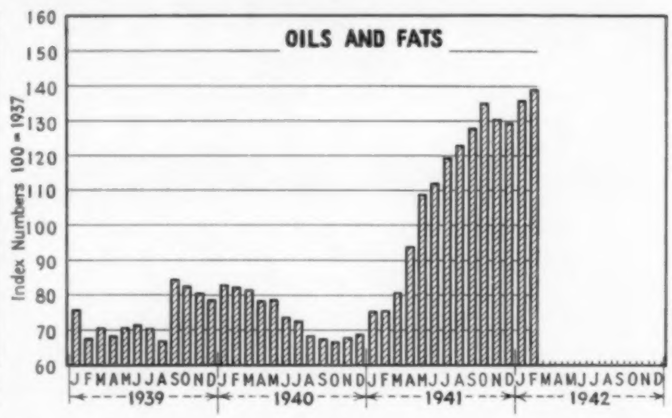
	Current Price	Last Month	Last Year
Menthanol, 95%, tanks, gal	.60 -......	.60 -......	.29 -......
97%, tanks, gal	.60 -......	.60 -......	.30 -......
Synthetic, tanks, gal	.28 -......	.28 -......	.30 -......
Nickel salt, double, bbl., lb	.13¼- .13½	.13¼- .13½	.13 - .13½
Orange mineral, csk., lb	.12¼-......	.11¼-......	.11 -......
Phosphorus, red, cases, lb	.40 - .42	.40 - .42	.40 - .42
Yellow, cases, lb	.18 - .25	.18 - .25	.18 - .25
Potassium bichromate, casks, lb	.09½- .10	.09½- .10	.08½- .09
Carbonate, 80–85%, calc. csk., lb	.06½- .07	.06½- .07	.06½- .07
Chlorate, powd., lb	.10 - .12	.10 - .12	.10 - .12
Hydroxide (c'stic potash) dr., lb	.07 - .07¼	.07 - .07¼	.07 - .07½
Muriate, 60% bags, unit	.53½-......	.53½-......	.53½-......
Nitrate, bbl., lb	.05½- .06	.05½- .06	.05½- .06
Permanganate, drums, lb	.19½- .20	.19½- .20	.18½- .19
Prussiate, yellow, casks, lb	.17 - .18	.17 - .18	.15 - .16
Sal ammoniac, white, casks, lb	.0515- .06	.0515- .06	.0515- .06
Salsoda, bbl., cwt	1.00 - 1.05	1.00 - 1.05	1.00 - 1.05
Salt cake, bulk, ton	17.00 -......	17.00 -......	17.00 -......
Soda ash, light, 58%, bags, contract, cwt	1.05 -......	1.05 -......	1.05 -......
Dense, bags, cwt	1.10 -......	1.10 -......	1.10 -......
Soda, caustic, 76%, solid, drums, cwt	2.30 - 3.00	2.30 - 3.00	2.30 - 3.00
Acetate, del., bbl., lb	.04½- .06	.04½- .06	.04 - .05
Bicarbonate, bbl., cwt	1.70 - 2.00	1.70 - 2.00	1.70 - 2.00
Bichromate, casks, lb	.07½- .08	.07½- .08	.06¾- .07
Bisulphate, bulk, ton	16.00 -17.00	16.00 -17.00	15.00 -16.00
Bisulphite, bbl., lb	.03 - .04	.03 - .04	.03 - .04
Chlorate, kegs, lb	.06¼- .06½	.06¼- .06½	.06¼- .06½
Cyanide, cases, dom., lb	.14 - .15	.14 - .15	.14 - .15
Fluoride, bbl., lb	.08 - .09	.08 - .09	.07 - .08
Hyposulphite, bbl., cwt	2.40 - 2.50	2.40 - 2.50	2.40 - 2.50
Metasilicate, bbl., cwt	2.50 - 2.65	2.50 - 2.65	2.35 - 2.40
Nitrate, bulk, cwt	1.35 -......	1.47 -......	1.45 -......
Nitrite, casks, lb	.06½- .07	.06½- .07	.06½- .07
Phosphate, tribasic, bags, lb	2.70 -......	2.70 -......	2.35 -......
Prussiate, yel. drums, lb	.10½- .11	.10½- .11	.10½- .11
Silicate (40° dr.), wks., cwt	.80 - .85	.80 - .85	.80 - .85
Sulphide, fused, 60–62%, dr. lb	.03 - .03½	.03 - .03½	.02¾- .03
Sulphite, crys., bbl., lb	.C2¼- .02½	.02¼- .02½	.02¼- .02½
Sulphur, crude at mine, bulk, ton	16.00 -......	16.00 -......	16.00 -......
Chloride, dr., lb	.03 - .04	.C3 - .04	.03 - .04
Dioxide, cyl., lb	.07 - .08	.07 - .08	.07 - .07½
Flour, bag, cwt	1.60 - 3.00	1.60 - 3.00	1.60 - 3.00
Tin Oxide, bbl., lb	.55 -......	.55 -......	.54 -......
Crystals, bbl., lb	.39½-......	.39½-......	.38 -......
Zinc, chloride, gran., bbl., lb	.05 - .06	.05 - .06	.05 - .06
Carbonate, bbl., lb	.14 - .15	.14 - .15	.14 - .15
Cyanide, dr., lb	.33 - .35	.33 - .35	.33 - .35
Dust, bbl., lb	.09¼-......	.09¼-......	.09¼-......
Zinc oxide, lead free, bag, lb	.07¼-......	.06½-......	.06¼-......
5% lead sulphate, bags, lb	.07¼-......	.06½-......	.06¼-......
Sulphate, bbl., cwt	3.40 - 3.50	3.15 - 3.25	3.15 - 3.25

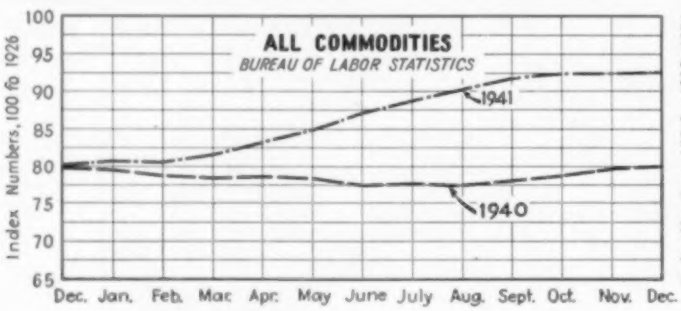
OILS AND FATS

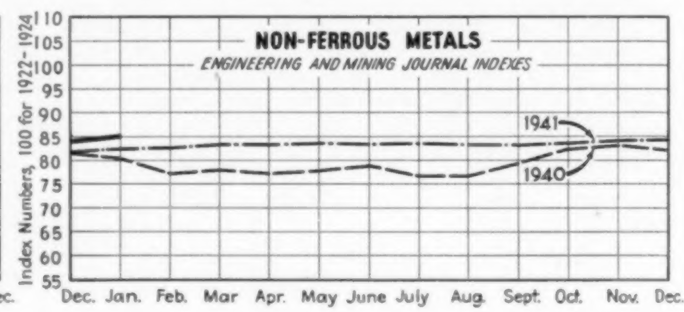
	Current Price	Last Month	Last Year
Castor oil, 3 bbl., lb	$0.12½-$0.13	$0.12½-$0.13	$0.10½-$0.11
Chinawood oil, bbl., lb	.38 -......	.35 -......	.27½-......
Coconut oil, Ceylon, tank, N. Y., lb	nom	nom	.03¾-......
Corn oil crude, tanks (f.o.b. mill), lb	.12¾-......	.12½-......	.07 -......
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.12¾-......	.12½-......	.05½-......
Linseed oil, raw car lots, bbl., lb	.117-......	.111-......	.097-......
Palm, casks, lb	.09 -......	.09 -......	.04½-......
Peanut oil, crude, tanks (mill), lb	.13 -......	.13 -......	.05½-......
Rapeseed oil, refined, bbl., lb	nom	nom	.13½-......
Soya bean, tank, lb	.11¾-......	.11½-......	.05½-......
Sulphur (olive foots), bbl., lb	.19 -......	.19 -......	.10 -......
Cod, Newfoundland, bbl., gal	nom	nom	nom ......
Menhaden, light pressed, bbl., lb	.112-......	.112-......	.09 -......
Crude, tanks (f.o.b. factory) gal	.63 -......	.60 -......	.35 -......
Grease, yellow, loose, lb	.09295-......	.09½-......	.04½-......
Oleo stearine, lb	.09½-......	.09½-......	.06½-......
Oleo oil, No. 1	.11½-......	.11½-......	.07½-......
Red oil, distilled, dp.p. bbl., lb	.12 -......	.12 -......	.06½-......
Tallow extra, loose, lb	.097125-...	.09½-......	.05 -......

Chem. & Met.'s Weighted Price Indexes









Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude bbl., lb	$0.52 -$0.55	$0.52 -$0.55	$0.52 -$0.55
Alpha-naphthylamine, bbl., lb	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb	.15 - .16	.15 - .16	.15 - .16
Aniline, salts, bbl., lb	.22 - .24	.22 - .24	.22 - .24
Benzaldehyde, U.S.P., dr., lb	.85 - .95	.85 - .95	.85 - .95
Benzidine base, bbl., lb	.70 - .75	.70 - .75	.70 - .75
Benzoic acid, U.S.P., kgs., lb	.54 - .56	.54 - .56	.54 - .56
Benzyl chloride, tech., dr., lb	.23 - .25	.23 - .25	.23 - .25
Benzol, 90%, tanks, works, gal	.15 -......	.15 -......	.14 -......
Beta-naphthol, tech., drums, lb	.23 - .24	.23 - .24	.23 - .24
Cresol, U.S.P., dr., lb	.11 -......	.10½- .11	.09½- .10
Cresylic acid, dr., wks., gal	.81 - .83	.81 - .83	.58 - .60
Diethylaniline, dr., lb	.40 - .45	.40 - .45	.40 - .45
Dinitrophenol, bbl., lb	.23 - .25	.23 - .25	.23 - .25
Dinitrotoluol, bbl., lb	.18 - .19	.18 - .19	.15½- .16
Dip oil, 15%, dr., gal	.23 - .25	.23 - .25	.23 - .25
Diphenylamine, dr. f.o.b. wks., lb	.60 -......	.70 -......	....
H-acid, bbl., lb	.45 - .50	.45 - .55	.45 - .50
Naphthalene, flake, bbl., lb	.07 - .07¼	.07 - .07¼	.07 - .07½
Nitrobenzene, dr., lb	.08 - .09	.08 - .09	.08 - .09
Para-nitraniline, bbl., lb	.47 - .49	.47 - .49	.47 - .49
Phenol, U.S.P., drums, lb	.13 -......	.13 -......	.12 -......
Picric acid, bbl., lb	.35 - .40	.35 - .40	.35 - .40
Pyridine, dr., gal	1.70 - 1.80	1.70 - 1.80	1.70 - 1.80
Resorcinol, tech., kegs, lb	.75 - .80	.75 - .80	.75 - .80
Salicylic acid, tech., bbl., lb	.33 - .40	.33 - .40	.33 - .40
Solvent naptha, w.w., tanks, gal	.27 -......	.27 -......	.27 -......
Tolidine, bbl., lb	.86 - .88	.86 - .88	.86 - .88
Toluol, drums, works, gal	.33 -......	.33 -......	.30 -......
Xylol, com, tanks, gal	.26 -......	.26 -......	.26 -......

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton	$22.00-$25.00	$22.00-$25.00	$22.00-$25.00
Casein, tech, bbl., lb	.25 - .29	.29½- .30	.13 - .14
China clay, dom., f.o.b. mine, ton	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors			
Carbon gas, black (wks.), lb	.0335- .30	.0335- .30	.02¼- .30
Prussian blue, bbl., lb	.36 - .37	.36 - .37	.36 - .37
Ultramarine blue, bbl., lb	.11 - .26	.11 - .26	.10 - .26
Chrome green, bbl., lb	.21½- .30	.21½- .30	.21 - .27
Carmine, red, tins, lb	4.60 - 4.75	4.60 - 4.75	4.85 - 5.00
Para toner, lb	.75 - .80	.75 - .80	.75 - .80
Vermilion, English, bbl., lb	3.05 - 3.10	3.05 - 3.10	3.12 - 3.20
Chrome yellow, C.P., bbl., lb	.14½- .15½	.14½- .15½	.14½- .15½
Feldspar, No. 1 (f.o.b.N.C.), ton	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Graphite, Ceylon, lump, bbl., lb	.08 - .10	.08 - .10	.06 - .06½
Gum copal Congo, bags, lb	.09 - .30	.09 - .30	.06 - .30
Manila, bags, lb	.09 - .15	.09 - .14	.09 - .14
Damar, Batavia, cases, lb	.10 - .22	.10 - .20	.08 - .24
Kauri, cases, lb	.18 - .60	.18 - .60	.18½- .60
Kieselguhr (f.o.b. mines), ton	7.00 -40.00	7.00 -40.00	7.00 -40.00
Magnesite, calc, ton	64.00 -......	65.00 -......	65.00 -......
Pumice stone, lump, bbl., lb	.05 - .07	.05 - .08	.05 - .07
-Imported, casks, lb	nom	nom	.03 - .04
Rosin, H., 100 lb	3.90 -......	3.76 -......	2.52 -......
Turpentine, gal	.81½-......	.82 -......	.47 -......
Shellac, orange, fine, bags, lb	.43 -......	.43 -......	.27 -......
Bleached, bonedry, bags, lb	.40 -......	.40 -......	.27 -......
T. N. Bags, lb	.32 -......	.32 -......	.16 -......
Soapstone (f.o.b. Vt.), bags, ton	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc. 200 mesh (f.o.b. Vt.), ton	8.00 - 8.50	8.00 - 8.50	8.00 - 8.50
200 mesh (f.o.b. Ga.), ton	6.00 - 8.00	6.00 - 8.00	7.50 -11.00

Industrial Notes

THE SAWYER ELECTRICAL MFG. CO., Los Angeles, has appointed George M. S. Snodgrass manager of its eastern sales division with headquarters in the Terminal Tower, Cleveland.

NAUGATUCK CHEMICAL CO., Naugatuck, Conn., has opened new quarters at 254 Fourth Ave., New York, for its aromatic division of which M. G. Couderchet is manager.

WICKWIRE SPENCER STEEL CO., New York, has elected Dean Rollans as vice-president in charge of sales and appointed William H. Husted assistant to the president.

THE TIMKEN ROLLER BEARING CO., Canton, Ohio, has advanced Dwight A. Bessmer of its purchasing department to the position of assistant director of purchases.

MANNING, MAXWELL & MOORE, INC., Bridgeport, Conn., has added James H. Withers to its sales force. Mr. Withers will be located in the Los Angeles office. Harold M. Moore former representative at St. Louis has been called for active duty and commissioned a captain.

AMERICAN CYNAMID & CHEMICAL CORP., New York, announces that Charles H. Stone has completed his period of personal service with the corporation but will continue in an advisory capacity. Mr. Stone headed a company bearing his name which was acquired by Cynamid in 1937.

S. G. FRANTZ CO., New York, has added Frank H. Boyd to its organization in the capacity of sales manager.

RAYBESTOS-MANHATTAN, INC., Passaic, N. J., announces the appointment of F. L. Curtis as vice-president. He also will continue as treasurer. H. E. Smith was appointed to succeed Mr. Curtis as general manager of the Manhattan Rubber Mfg. Division. J. H. Matthews is now assistant factory manager.

THE B. F. GOODRICH CO., Akron, has made William S. Richardson general manager to succeed J. H. Connors who has resigned because of ill health.

PENNSYLVANIA SALT MFG. CO., Philadelphia, has promoted George B. Beitzel from manager of sales to vice-president in charge of sales. Mr. Beitzel also is president of the Sales Managers' Association of Philadelphia.

GENERAL ELECTRIC CO., Schenectady, N. Y., has promoted W. A. Wirene to the position of assistant sales manager of the petroleum, chemical, mining, and steel mill section of the industrial department.

WOLVERINE TUBE CO., Detroit, has appointed Horace Bassett to the position of factory manager.

CHEM & MET NEW CONSTRUCTION

	Current Projects Proposed Work	Current Projects Contracts	Cumulative 1942 Proposed Work	Cumulative 1942 Contracts
New England	$50,000	$125,000	$50,000	$125,000
Middle Atlantic	140,000	31,170,000	751,000	22,658,000
South	140,000	2,750,000	140,000	2,750,000
Middle West	5,050,000	510,000	8,090,000	10,360,000
West of Mississippi	29,910,000	3,650,000	33,340,000	28,840,000
Far West	4,650,000	....	4,650,000	121,000
Canada	920,000	....	1,252,000	....
	$40,860,000	$38,205,000	$48,273,000	$64,854,000

PROPOSED WORK

Ark., Magnolia—Arkansas-Louisiana Gas Co., Slattery Bldg., Shreveport, La., plans to construct a gas sweetening plant in the Macedonia Field. Estimated cost will exceed $150,000.

Calif., Sacramento—Hancock Oil Co., 1501 McCormack St., plans to rebuild its plant. Estimated cost $50,000.

Calif., Sacramento—Signal Oil Co., 1506 Sproule St., plans to rebuild its plant. Estimated cost $50,000.

Calif., Sacramento—Weits Oil Co., Lodi, plans to rebuild its plant here. Estimated cost $50,000.

Conn., Stamford—Baer Bros., 700 Canal St., Stamford, paint manufacturers, plan to construct 2 story factory. Estimated cost $50,000.

Ill., Chicago—Headquarters Pure Oil Co., 35 East Wacker Dr., plans to construct gasoline refinery. Estimated cost $3,000,000.

Ill., Lockport—Texas Co., 332 South Michigan Ave., Chicago, Ill., plans to construct additions to plant here. Estimated cost $2,000,000.

Ind., Noblesville—Firestone Tire & Rubber Co., Firestone Park, Akron, O., plans to build an addition to its plant here. Estimated cost including equipment $50,000.

Ia., Mason City—Northwestern States Portland Cement Co., Mason City, plans to rebuild its cement plant here recently destroyed by fire. Estimated cost $100,000.

Nev., Las Vegas—M. A. Hanna Co., Leader Bldg., Cleveland, O., plans to construct a manganese mill near here. Estimated cost $4,500,000.

N. J., North Bergen—Allite Tungsten Corp., 540 39th St., Union City, N. J., will soon receive bids for the construction of a 1 story, 85x85 ft. warehouse. Frank A. Hecker, 6030 Bergenline Ave., West New York, N. J., Archt.

N. C., Thrift—(Paw Creek P. O.)—American Oil Co., 100 South Tryon St., Charlotte, N. C., T. A. Aldridge, Div. Mgr., plans to construct a petroleum terminal, tanks, buildings and storage facilities on Hy. 27. Estimated cost $40,000.

Okla., Orlando—C. E. Johnson & Co., 1517 West Liberty Ave., Pittsburgh, Pa., is having plans prepared for a carbon black plant here. Estimated cost $500,000.

Pennsylvania—Edward J. Kelsky, c/o Keps Electric Co., 638 Grant St., Pittsburgh, Pa., plans to improve and construct additions to various plants of Climax Fire Brick Co. in Clarion and Armstrong Counties. Estimated cost $100,000.

Tenn., Jackson—Ashby Veneering Co., Jackson, plans to rebuild its drying and equipment room. Estimated cost $100,000.

Tex., Baytown—Humble Oil & Refining Co., Baytown, plans to construct and equip a refinery here.

Tex., Dallas—Headquarters Magnolia Petroleum Co., Magnolia Bldg., plans to expand its gasoline refinery. Estimated cost $15,000,000.

Tex., Kilgore—Headquarters Southport Petroleum Co., Kilgore, plans to construct gasoline refinery. Estimated cost $4,000,000.

Tex., Mt. Pleasant—C. Murchison & Associates, First Natl. Bank Bldg., Dallas, has acquired the plant formerly owned by the Talco Asphalt & Refining Co., and will expand and improve same, also build an additional pipe line.

Tex., Port Arthur—Texas Co., 720 San Jacinto St., Houston, is having revised plans prepared for a lubricating oil plant. Estimated cost $2,500,000.

Tex., Port Arthur—Texas Co., 720 San Jacinto St., Houston, plans to construct gasoline refinery. Estimated cost $7,500,000.

Tex., Texas City—Firestone Tire & Rubber Co., Firestone Park, Akron, O., has taken an option on a site here and plans to construct a plant.

Tex., Texas City—Pan American Refining Corp. Corp., Texas City, plans to enlarge its plant here.

N. S., Sydney—L'Air Liquide Ltd., 1111 Beaver Hall Hill, Montreal, Que., Can., plans to construct a new plant.

Ont., Eastview—Canadian Tile & Mosaic, Ltd., Eastview, plans to construct a tile and ceramics plant. Estimated cost $40,000.

Ont., Ottawa—J. R. Booth, Ltd., Booth St., will soon receive bids for the construction of a paper mill.

Quebec—Consolidated Mining & Smelting Co. of Canada, Ltd., 215 St. James St., Montreal, plans to construct a magnesium plant. Estimated cost $500,000.

Que., Asbestos—Canadian Johns-Manville Co., Ltd., Sun Life Bldg., Montreal, plans to remodel and build addition to plant here. Estimated cost $250,000.

Sask., Alaska—Natural Sodium Products, Ltd. Moose Jaw, plans to construct a plant. Estimated cost $50,000.

CONTRACTS AWARDED

Conn., Naugatuck—U. S. Rubber Co., Inc., 58 Maple St., has awarded the contract for the construction of a plant for the manufacture of aniline to W. J. Megin, Inc., 51 Elm St. Estimated cost $85,000.

D. C., Wash.—War Dept. has awarded contract for addition to explosives plant (location not disclosed) to Fraser-Brace Engineering Co., Inc., 10 East 40th St., New York, N. Y. Estimated cost $10,000,000.

D. C., Wash.—War Dept. has awarded contract for explosives plant (location not disclosed) to J. G. White Engineering Corp., 80 Broad St., New York, N. Y. Estimated cost $20,000,000.

Ill., Broadview—(mail Bellwood)—Hub Plating Co., 1233 52nd St., Cicero, Ill., has awarded the contract for a 1 story, 90x240 ft. factory to E. Buzovsky, 5314 West 25th St. Estimated cost $50,000.

Ill., Chicago—Allen B. Wrisley Co., 6801 West 65th St., has awarded the contract for a 1 and 2 story, 100x106 ft. soap factory addition to Mutual Contracting Co., 2532 Warren Blvd. Estimated cost $40,000.

Ky., Louisville—Hycar Chemical Co., c/o B. F. Goodrich Rubber Co., 100 West Bway., and Phillips Petroleum Co., Preston and Barnett Sts., has awarded the contract for an addition to its plant to Batson-Cook Co., Inc., West Point, Ga. Estimated cost $2,750,000.

Me., South Portland (br. Portland)—Air Reduction Sales Corp., Lincoln Bldg., New York, N. Y., has awarded the contract for an addition to its oxygen plant on Madison St., to F. W. Cunningham & Sons, 181 State St., Portland. Estimated cost $40,000.

Mo., St. Louis—Mallinckrodt Chemical Works, Mallinckrodt and Second Sts., has awarded the contract for rebuilding its warehouse to James Black Masonry & Contracting Co., 317 North 11th St. Estimated cost including equipment $40,000.

N. J., Cape May—Northwest Magnesite Co., Farmers Bank Bldg., Pittsburgh., Pa., has awarded the contract for the design and construction of a 1 story, 200x300 ft. and three 3 story, 50x60 ft. buildings, also power plant, to McDonald Engineering Co., 1 North LaSalle St., Chicago, Ill. Estimated cost $1,000,000.

N. J., Clark (Rahway P. O.)—Lewis Asphalt Engineering Co., 30 Church St., New York, N. Y., has awarded the contract for rebuilding its asphalt plant recently destroyed by fire to Alex Milne, 20 Race St., North Plainfield, N. J.

N. J., Newark—U. S. Industrial Chemicals, Inc., 390 Doremus Ave., has awarded the contract for altering its plant to E. M. Waldron, Inc., 40 Park Pl. Estimated cost $50,000.

N. J., New Brunswick—E. I. du Pont de Nemours & Co., Inc., Jersey Ave., has awarded the contract for a 1 story, 60x120 ft. manufacturing building to Rogers & Sons Construction Co., 71 John St., New Brunswick. Estimated cost $40,000.

O., Akron—Firestone Tire & Rubber Co., Main St., has awarded the contract for the construction of a factory building to H. K. Ferguson Co., Hanna Bldg., Cleveland. Estimated cost $300,000.

O., Cleveland—National Bronze & Aluminum Foundry Co., 8800 Laisy Ave., has awarded the contract for interior alterations to its factory to H. L. Vokes Co., 5300 Chester Ave. Estimated cost $40,000.

O., Cleveland—Wellman Bronze & Aluminum Co., 6107 Superior Ave., has awarded the contract for rebuilding its factory and warehouse to H. J. Slatmyer & Son Construction Co., 203 Lakeside Ave. Estimated cost $40,000.

Pa., Erie—Hammermill Paper Co., East Lake Rd., Erie, has awarded the contract for a 1 story, concrete bleaching plant addition to Henry Shenk Co., Sassafras St., Erie. Estimated cost $40,000.

Tex., Kilgore—R. Lacy Refinery, Kilgore, will improve its refinery in this vicinity. Work will be done by force account and sub-contracts. Estimated cost $50,000.

Tex., Port Arthur—Gulf Refining Co., Port Arthur, has awarded the contract for refinery near here to Lummus Co., 420 Lexington Ave., New York, N. Y. Estimated cost $2,800,000.

Tex., Texas City—Monsanto Chemical Co., 1700 South Second St., St. Louis, Mo., will convert old sugar refining plant here into chemical manufacturing plant. Work will be done by day labor and force account. Estimated cost $800,000.